TOOLS

HUBERT COMTE

Making Things Around the World

U.S.A. $75.00
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The world is filled with tools—some simple, some complex; some extremely ancient, some very new. Where did they come from? How did they evolve? In what societies did they emerge? How have they been put to use over the centuries?

This fascinating book answers these questions and many more. In *Tools: Making Things Around the World,* author Hubert Comte presents an astonishing international assortment of hand tools used for working a variety of materials, from metal, leather, and glass to wood, stone, and soil. Discussing every tool—and the techniques for using it—within its cultural and historical context, he illustrates that each is a unique creation.

The informative text, with its poetic tone and rhythm and its many quotations from literature, brings the tools to life by evoking the sounds they produce, their impact on materials, and the skillful movements of those using them.

Lavishly illustrated and filled with evocative detail, this book celebrates human ingenuity and the brilliance of craftspeople by depicting tools not as inert objects, but as instruments of a particular culture intended for use in a specific time and place.

If you have ever used a hammer, knife, ax, or trowel—or are simply interested in their origins—this book is for you.

297 illustrations,
including 226 plates in full color

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Tools

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HUBERT COMTE

Tools

Making Things Around the World

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NOW WATCH
CLOSELY HOW
I PASS
FROM THIS
PLACE TO THE
TRUTH YOU
WISH TO KNOW,
SO YOU MAY
LEARN TO FORD
THE WAY
ALONE.

Dante Alighieri
Divine Comedy
"Paradiso," II, 124–126

DEFINING TOOLS

The Tools Family

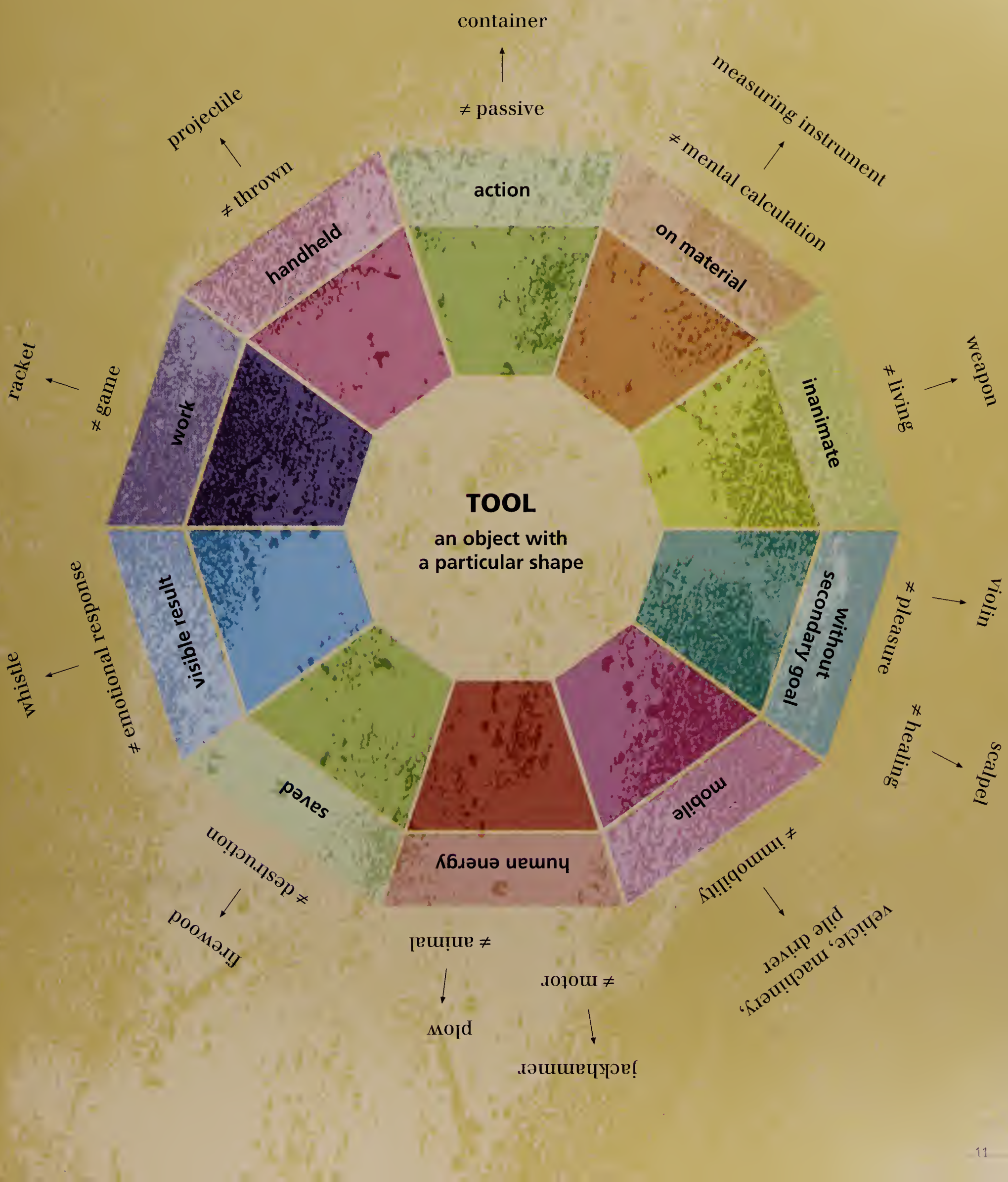
Before all else, I see each tool as an individual—a unique being with its own particular shape and purpose in life. However, because a tool is rarely alone, those dearest to it will be nearby. There are its other halves, like the rifle for the skinning knife, or the anvil for the hammer. There are the tools that helped make it: the draw knife for the hatchet's handle, the file for the sledgehammer. There are the tools used in sequence to complete a job: an awl before a needle, a billhook after an ax.

A tool is my contemporary, but it has witnessed the distant past; it is a being at the head of a line of descendants who are connected by a common thread that leads back to the first tool. Each of our tools represents the latest branch stemming from a central trunk. With the passing from stone to metal tools, many diverse shapes and sizes were born, always responding to the specifications of growing needs: cutting, shaping, splitting, piercing, driving, and so on.

As constant companions of human progress, tools have seen thousands of years of calm interrupted by earth-shattering revolutions. Like lost voyagers, they did not know where they were headed; but it is certain they would never return.

Throughout this book's journey over the long course of the ages, through various countries and civilizations, and across the minds that explored the heart of a specific task, the link to the first object human beings held in hand to confront matter will be ever present. One prodigious day, the mind was able to go beyond the hand's lamentable shortcomings—its injuries and failures—and experiment with the simple capacity to take, to handle. It all began. The tools we hold are surprisingly young. So little has changed since the beginning that, ironically, those original tools are but a few steps away.

To define is to eliminate. Among the objects that serve, only tools are subject to certain defining conditions.


TOOL
an object with
a particular shape
action
handheld
on material
inanimate
work
human energy
mobile
without secondary goal
visible result
saved
container
≠ passive
projectile
≠ thrown
measuring instrument
≠ mental calculation
racket
≠ game
weapon
≠ living
whistle
≠ emotional response
violin
≠ pleasure
scalpel
≠ healing
vehicle, machinery, pile driver
≠ immobility
jackhammer
≠ motor
plow
≠ animal
firewood
≠ destruction

Defining Tools

The notion seems so simple, so elementary, that everyone thinks they can define the word *tool*, using the ax, hammer, or plane as an example. But ambiguities arise very quickly. The word has often been used quite loosely, and grouping tools together will lead to mistakes. It's therefore necessary to set the terms for membership to the tool family, to see which objects are definitely a part of it and which, on the other hand, should be classed in other categories of related objects.

AN OBJECT

A tool is a material object, belonging to the solid, three-dimensional world. By object, we mean that which is inert and inanimate, which eliminates everything that is living, animal or vegetable. In a famous movie, Buster Keaton picks up a crab from the ocean floor to use as a clipper. The crab fits into the commonly used idea of a tool, but isn't a tool by nature.

The word *material* belongs to the visible, tangible world. Technical methods or principles are not tools. They allow tools to be invented, and without them we wouldn't be able to use tools or reproduce them—but they aren't tools.

Being inert, the tool is not alive, but it is also not a robot imitating life. An automaton that chops down a tree is not a tool: its energy doesn't come from human muscles but from a wound-up mechanism or from an outside source. However, the saw that the robot manipulates is a tool. It's the same kind that a person—whom the robot is only replacing—might use.

MOBILITY

It's easy to distinguish between mobility and immobility. On the one hand, you have something that you can hold in your hand, that you can carry, manipulate, put into action. On the other, you have something stationary, heavy, permanently standing where it has been attached or put to rest.

Nevertheless, with the onslaught of new needs, some tools have become larger and heavier (just as when animals evolve and develop in ways that will benefit them). Tools have gone from being handheld to being mounted on a base, while continuing to be maneuvered by hand. They are therefore mobile. Sheet-metal shears, which are fastened to a workbench, are an enormous tool. The baker's bread slicer is attached to a board over a metal opening. The clogmaker's shaper is a heavy gouge that can move in all directions but is secured to a block by a hooked end that passes through a ring. The sugarloaf cracker is attached above a receptacle that catches the falling pieces: it's designed like a handheld nutcracker, and the whole thing remains mobile.

A cooper's and carpenter's long jointer is less obvious. The principle is simple—it's a very large plane turned upside down. The body is a framed beam, as long as four or five feet, that holds the blade. The near end of the frame rests on the ground and the far end is raised on two legs. The worker straddles the resulting inclined bench. The long jointer is the end result of a series of planes that have grown larger and larger, beginning with the luthier's finger plane (for which only the tip of the finger is required), through the block planes used by a coach builder or a cabinetmaker, finally arriving at the massive grooved rabbet plane operated by two workers who alternate pushing and pulling. Through this progression, the relationship between the plane and the wood to be smoothed is reversed: the plane is larger and stands

still; it's flipped over so that the blade is on top and the piece of wood is moved to meet the blade. It is indeed a plane, even if it doesn't meet the requirement of having to be operated manually.

Conversely, the principle function of a number of objects is to bear striking. These are passive objects, whether they're table-like, like the blacksmith's anvil or the butcher's block, or receptacles, like the mortar used by African women to grind millet. They can be defined as the complements of active tools powered by the human hand, such as the forging hammer, the butcher's cleaver, and the pestle.

SETTING IN MOTION

A tool is the doer's intermediary, useless unless it is taken in hand. The statement seems so general that we misjudge its implications. There are indeed objects that can serve without being put into action. A jug—hollow and waterproof—will hold water, a triangular wedge will keep a door open, and a heavy metal paperweight will keep papers in place.

Consider the indispensable objects in a carpenter's or blacksmith's workshop, like the clamp or vise whose function it is to hold or grip. These are not tools, for their role is to be fixed. Through their screw-and-lever system, they simply withstand the force that is applied. They're only put into motion at the beginning and end of a process, when placing or removing, for clamping or unfastening. In the interim, their role is to be inactive. These objects are the counterparts of actual tools, part of the broader notion of a set of tools.

THE SURROUNDING WORLD

The tool's action can be summarized as contact between two materials: the wooden teeth of a rake with hay, the steel of the bush hammer with stone, the bone of the bark spud with bark.

The result of this action is visible. The material's aspect has been modified, whether its mass has been reduced or increased, whether it has been divided or moved, and the change is immediately perceptible, either by a touch or a glance. The tool exists to allow people to change the world and to appropriate parts of it. There is no such thing as a tool that doesn't leave a mark. In many cases, the traces left by tools at work are twofold: the log becomes a square-sectioned beam, and this is the essential effect, the desired result; but there is also a loss—the sawdust—a kind of tithe taken when the tool passed through.

This notion of material evidence marks the boundary between tool and instrument, which can be found side by side in a mason's or carpenter's toolbox. There is not a single set of tools that doesn't include its indispensable counterparts, used to measure or mark: the plumber's folding ruler or the mason's string level, the carpenter's plumb line, the locksmith's compass, the tiler's level, or the roofer's framing square. They are used to measure or take down measurements, to make a straight line or circle, to true a surface to vertical or horizontal planes. It is certain that these are rudimentary objects, and they are very simple to use and manipulate, but they belong to the family of telescopes and sextants, which are instruments.

Workers also have instruments, of course, and these link what is considered blue-collar to white-collar work. The work of a mason, for example, touches upon the work of an architect. Even if the instruments they use differ in size and material, and even if the frequency with which they are employed isn't the same, the tools are used to accomplish the same tasks. The ruler, the compass, and the square have the identical purpose, no matter who is using them.

The compass outlines a circle, and the saw will follow this line marked on the board. Something has intervened in the material's world. Nevertheless, the trace of the compass or scriber is light, like a drawing: the mark is not irreparable. It won't dent the surface. There is room for change, for

regret. This mark can therefore be seen as the indication of a decision preceding an action that is in fact irreversible in character. The artisan who has just traced a line can change his mind, erasing the pencil mark on the beam or the colored chalk left by a snap line on the wall. He can gently pass the plane over the scratch line left by the scriber. However, the croze used by the cooper to cut out a groove in the barrel throat to hold the barrel bottom is most definitely a plane: behind it, a groove is cut. The action on the material is irreversible and often violent, like a weapon. It comes as no surprise that the pocketknife and dagger issue from common ancestry, whereas the blade of the flint tool cannot be placed in either category.

A VISIBLE AND IMMEDIATE RESULT

Opposite:
Tina Modotti, a committed photographer, speaks.

The tool's action belongs to the visible world, is situated in the present, and foresees no future: its result is there, right below the eyes of the person holding the tool. The surgeon is therefore misusing language—flirting with it—when calling her operating instruments "tools." It's true that the scalpel cuts skin and tissue in the same way as other slicing objects, that the saw is used to amputate bone just like the saw of a carpenter. Despite this appearance of similarity, however, a scalpel is not part of the world of the artisan. The surgeon practices an art, tapping into a body of knowledge that is infinitely greater in scope and responsibility than the simple knowledge of materials. The surgeon works on the living and relies on life to be on her side so that the patient can be cured. Sights are set on the future, a future that is still unknown and anticipated. A spectator who knows nothing of surgery would think he were witnessing a criminal act, barbarism, madness. Because the workings of the mind are so predominant in surgery, we can conclude that the surgeon uses instruments.

WORKING ON THE INANIMATE WORLD

Weapons are objects used to act upon the living world. It is true that at its distant origins, the punch or the ax might have been used indiscriminately for hunting, war, and work. But whether they are held in the hand or thrown, weapons (knives, arrows, javelins) stand outside the world of tools. The concept of a killing tool, therefore, is a flagrant contradiction, reflecting our yearning to make the world one—even if we subdivide it immediately. However, with words as proof, the world's diversity is undeniable. The felling ax would never be called "a weapon to cut the trunk of a tree."

Whether they are used to kill or capture animals, traps—of which there is a huge variety—belong to the category of equipment.

Everything that contributes to catching sea animals falls under the heading of "equipment," from the fishing pole to the harpoon, including the trawl and other nets. This is true even though fishermen, in the most general sense of the word, call their nets—and small boats—their "tools of the trade."

Unwittingly, we establish a sharp distinction between an action taken upon an animal as opposed to upon a plant. A plant that grows and reproduces, but doesn't move, is considered an inferior life-form. Knowing that wasps and hares are members of the animal world, people will say that they have killed them, but they will speak of weeding a thistle, cutting a bramble, or picking a flower. The gardener and horticulturist are considered to use tools because they work with plant life.

PERFORMING A JOB

No tools, no work. On one end of the spectrum, a person performs a tiring act that quickly becomes laborious when repeated; but, in the end, workers get paid, which allows for their survival. Workers' tools, their companions through long, often trying, hours, are not associated with the difficulty of the job; nor are they hated or accursed. They are seen as silent helpers, assistants who

greatly facilitate the task, making the job possible as long as they are used properly. The tool's logic must be seen and understood, must be teamed up with to fight against the material. Naturally, the perception of the tool will vary greatly depending on the condition of its employer. Winegrowers work for their own benefit and that of their loved ones, relying on their spades, and they see that tool as a friend to be respected and cared for. For slaves, forced laborers, or prisoners, however, the same spade is the symbol of their miserable, loathsome condition, and it turns into the object of their hatred. In their hands, the spade seems heavier and becomes an instrument of torture, sadistically invented by the master or torturer. They dream of the day when, the end finally at hand, they can take revenge on the spade. Because they weren't able to use the tool as a weapon, they then split it into pieces in a gesture resembling what they would do to the person who put it in their hands to begin with.

The simplest of tools: a lump of metal with a wooden lever. Pick it up and give a whack.

Misuse

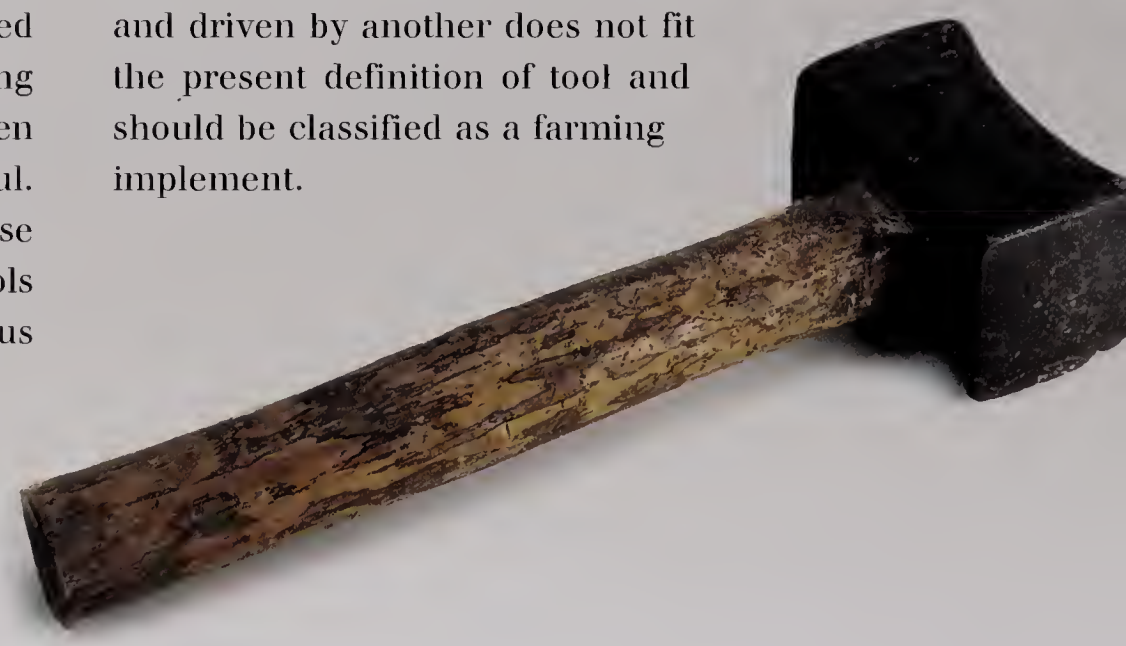
The tool is so much a tool that we are horrified when it is not used for work, when it seems to have escaped itself, when it is used for purposes other than building our world and enriching us, when it is anything but quietly useful. These perversions affect us because they seem sacrilegious—the tools that help us build, that help us improve our lives, turn into accomplices in death and destruction. Furthermore, they frighten us because all of a sudden, they are used not on raw, inanimate material, but on fragile human flesh, alive and suffering. There are many examples: in western France in the late eighteenth century, the Chouans armed themselves with scythes with vertical handles to defend their ideals (one shudders, thinking of the horrible damage); Trotsky was assassinated in Mexico by the blow of an ice pick. A thousand and one news stories tell of killers armed with billhooks, hammers, and felling axes.

In churches, to firmly establish the heroic saintliness of martyrs in the face of the barbarous ferocity of their tormentors, painters have depicted horrible and sadistic executioners torturing both male and female saints with the basic tool of their profession. In one example, you'll see a carpenter summoned to saw a miserable woman in half; elsewhere, there'll be a butcher raising his meat cleaver above the neck of a saint; or, in a flood of light, a blacksmith's tongs grabbing flesh for a long torment. In order to better dramatize religious history, painters have chosen to portray tools in large scale, and the effect is assured: the executioners appear even more brutal, and their victims can be ever the more pitied.

POWERED BY HUMAN ENERGY

One might be surprised to learn that in this review of the tools of the world, space does not permit us to include the few tools used by animals.

Recently, the plow, harrow, and thresher have diverged from the world of tools; they are driven by a person but use the energy of an attached animal (horse, mule, bull, camel, buffalo). Our current language groups these under farming implements. As always—and probably because we are exploring an area that is in such a close relationship with the living—the boundaries are not clear-cut in every case. However, it does seem that the Asian plow pulled by one man and driven by another does not fit the present definition of tool and should be classified as a farming implement.



The palm was once used for smoothing. The trowel has replaced it.

The notion of human energy needs to be explained. We're talking about the energy of a single person. This same person will carry, handle, and guide the tool, facing the material alone, the hand leading the way and the muscles flexed, the weight of the body applying its power, and the eye monitoring.

Furthermore, what is put into motion by natural energy like wind or water distances us anew from what we call a tool. In such cases, a person does not operate a tool, but reacts to an instruction; the natural forces set a mill's grinding wheel or a trip-hammer and its battery of drop hammers in motion, with gears acting as intermediaries.

The plumbers' electric drill and the lumberjack's chain saw, which are both used every day in these two professions, are part of a new generation of tools. They can be defined as mechanized tools, or portable machine-tools. The user only carries, holds, drives, and turns them on and off. People don't provide them with the energy necessary for them to work; some are powered by gas, others by electricity. Without this supply, this umbilical cord, they are inanimate, useless, dead.

When we note just how laborious—and often dangerous—it is to take down trees, we are grateful that the almost magical chain saw was developed and has become so popular. We can only hope that some changes will be made to make them more discreet.

HELD IN THE HAND

The English astronomer William Herschel said that looking is an art and therefore one can learn how to look. The simplest of gestures deserves careful observation. One must not skirt the essence of things, living according to the approximations and errors of so-called common knowledge.

The hand can act in many ways according to how far it is from the material to be worked. The baker's hand kneading dough, the fingers of the potter, and the sculptor's shaping touch all dive into the heart of the material. The fingers dig, smooth, and pinch, while the palm flattens or gives the sides of clay a profile. Hands can act as tools. Conversely, the saddler will use only the hand's pinching function to sew, instead of using a full movement. The needle is taken between the thumb and index finger, like a draftsman's pencil or an engraver's burin. Contact with the material happens through a very elementary object that is, in fact, its own handle. Where the hand grasps has not been determined beforehand; it will vary.

However, when blacksmiths use a cutter for shaping a hoof, they are twice removed from the material they are working on. The hand has been fitted to a wooden handle through which they control the iron blade. The hand—which, as Odysseus said, had a thousand ways, because of the range of its possibilities—takes on new form, different from the two aforementioned cases. Its sole purpose is to be a tightened vise fixed to the tool's wooden handle. In fact, because the hand is so versatile, a hollow tube formed by the palm and fingers and bolted shut by the end of the thumb can be made to fit all kinds of tools. Thus we begin to understand the true nature of the relationship between hand and tool.

The saying "the tool is the extension of the hand" is appropriate only as a casual statement. In fact, it is completely imprecise and false, even deceptive. A hand that works a tool is a living organ that has surrendered its natural

genius and its infinite diversity. It has transformed itself into an extension, a simple bolt, something that holds the tool or machine-tool like a ferrule. It wraps around the tool shank. The other end is designed for a special task, a precise operation that the hand is incapable of carrying out.

CONTACT WITH THE BODY

First, there is the "other hand," the left one—since through habit or by nature, most of us are right handed. The list of tools held with two hands is long: the scythe, flail, spade, hoe, felling ax, and gang saw, for example, are worked in this way because of their size or weight. With other tools, two hands are used, not because of the length of the lever or the weight of the tool, but to make it possible to completely control the position of the object for finishing a detailed task. This is the case with a wood turner's gouge: the artisans must keep still, and their process requires both strength and mindfulness, as they push down and direct the blade at the same time. Just a knot in the wood will cause the blade to skip or swerve.

A second hand can be used occasionally: the billhook, the hatchet, and the hammer are held with two hands when the person using them would like supplementary power; when there is a thicker branch to cut, a longer log to split, a nail to be hammered into a tougher material.

In many other cases, if the left hand isn't used on the tool, it will nevertheless be indispensable to completing the job. It will hold the piece being worked on, bring it to the tool to complete the action, so to speak. The left hand will steady the branch on the block so that it can be split by the billhook and will push aside the sheep's wool while the shears do their work. It will hold a cold chisel full in hand, or a nail between the thumb and index finger while the mallet falls. Protected by the harvester's wooden "finger," the left hand gathers and brings the stalks to be cut to the sickle. Or it will work with the flail, the "needle," which fulfills the same function.

The Neck

Makers of wooden clogs use their necks to push one side of the long T-shaped scoop that hollows out the bottom of the clog. Their two hands grab the other side, sometimes pushing, sometimes pulling, creating a rotating movement.

The Groin

To rough-hew a log into a clog, the artisan pushes a tool against his groin, which is protected by a thick leather work apron. Despite its name, the clogmaker's hatchet (characterized by a blade unaligned with the axis of the pear-shaped handle) cuts wood in the way a penknife sharpens a pencil.

The Jaw

Eskimos hold a piece of wood designed to fit the tip of a drill in their teeth. Their hands manipulate the bar crossing the tool. Certain primitive tribes use the same method for making fire. The appeal of such a device is understandable since it conveniently leaves the hands free to maneuver the drill. The tool is controlled through the wooden piece, and all the weight of the body can be applied to the tool.

Upper Torso

A wooden board can be hung around an artisan's neck or held in place by suspenders. Several small crevices are carved in it to hold the point of the tool in place, enabling it to be pushed forward without slipping. The hand doesn't work the breast drill handle and is therefore free to stabilize the piece being drilled. Because this hard wooden board is placed against the center of the body, it is called a "conscience."

The Foot

When people dig, they sink a tool into the earth, using their foot on the side of the blade. The effort becomes much easier when the weight of the entire body pushes the tool down.

The classic hay cutter, which requires the use of both hands, will sometimes have a "pedal" for the foot: one needs the strength from both arms, as well as the entire body leaning into the tool through the foot in order for the blade to cut into the haystack.

The winegrower can use a foot to set vine stakes. A U-shaped blade attached to the side of a special clog will clasp the stake just with its weight. As the worker leans into the stake, one hand will hold the pick straight up while the mallet drives it into the ground.

In certain cultures where the climate is warm enough for one to be barefoot, it's common to see artisans using a foot like a third hand. The makers of pipe stems from Katmandu hold a wooden stalk between their big and second toes. In Marrakesh or Guadalajara, cabinetmakers who work outside hold their tool steady with their feet. While the pick planter only pushes down, the turner uses the bare foot as a sensor. In such cases, talking about a third hand is more than just a concept.

Finally, we can cite another specific case: the pointed wooden shoes used in the Limousin region of France to peel chestnuts are designed for more specific work, having evolved from when winegrowers trod barefoot on grapes.

This man is holding the end of his drill between his teeth, a traditional use of the body.

SAVING THE OBJECT

There is a shocking and dramatic difference between humans and animals. A few rare animals use tools (in the true sense of using material objects outside the body) and do so with great ingenuity. The sea otter arms itself with a stone to strike an abalone shell against its belly so that it can eat the meat; a Galápagos Island finch drives a long cactus needle into the hole it has drilled in a trunk to dislodge the insect it desires; an Egyptian vulture cracks an ostrich egg by dropping a stone on it from its beak. These are momentary tools. The

animals found them and knew how to use them; they didn't invent them and produce them again after. The objects are left where they were found once they served their purpose. The animal certainly retains traces of the past, and is fully in the present, but it is incapable of envisioning the future. It doesn't understand that the stone or the needle might be useful again. Conversely, if people are nomadic, they will carry their tools with them, and once settled, will store them for later; people have the ability to foresee that they will have use for them again. Stone tools with sharpened edges have been found beside skeletons and skulls that are certain to be human remains.

Opposite: **For people who customarily go barefoot, using their toes to complete a job is simply natural. Pipe-stem maker from the Middle East.**

Saving objects and inventing improvements to them has allowed humankind to progress from the random stone to the spacecraft. We must, however, temper our praise for the human race: if the animal's "goal" is to stay alive and assure the survival of its kind, then the otter, finch, and vulture have succeeded completely. They haven't disappeared from the surface of the earth. Why hold onto stones and cactus needles if the earth abounds in them? Why would one exhaust oneself carrying them around? To save time? According to which clock?

The tools of a traveling artisan are grouped together in a toolbox; those belonging to cabinetmakers are lined up on a rack in front of their workbenches; and prudent mechanics often outline the silhouettes of the tools on a large board where they will be hung after they've been used so it will be immediately obvious which ones are missing. Putting tools away in their proper places is imperative; signs posted in workshops might remind absentminded or messy workers: "Everything in its place; a place for everything."

However, just as with a work of art in a museum, conservation—taking care of tools—implies something more than simply hanging an object on the wall and locking the door. True conservation is about making something last. The artisan and farmer will grease the blades of tools that may not have been used for some time. The cabinetmaker's precious planes will be protected with turpentine and maintained ("nourished") with wax to prevent them from drying out.

There are ways tools last. To preserve a tool is to limit its use wisely: a tool isn't used up when it's worked; it will wear down, but it won't disappear. It will come in handy again if it is preserved according to its essence, according to its vocation, to the use it was intended for, never straying from this purpose. The handle of the screwdriver will split if it's hammered as if it were a cold chisel. A knife's blade will snap if it is used as a lever. The hatchet's cutting edge will chip if it's selected to cut a branch on the ground. This is why there are rules and restrictions—and why professionals vigilantly watch over amateurs and the curious who borrow their array of tools.

I wanted to offer this long definition of tools, to trace their sometimes "porous" limitations, so that—inconclusive points and unresolved questions aside—the category of tools might be rendered precise. This will simplify the long, uninterrupted chain of objects born one after the other, constantly being improved, diversified, and infinitely specialized; it will link the time-honored pebble to our modern steel hammer in one fell swoop. The word *tool* has been misused to the point that we no longer notice it. It serves as a blanket, a container filled miscellaneously and disparately. However, only in indicating their commonality can we observe, compare, understand, and make the connection between the many brainchildren of human genius, for a tool is not alone.

Jacques Boucher de Perthes

A unique and inspiring contemporary of the first humans, a sharpened flint tool marries efficiency with elegance.

Jacques Boucher de Crèvecoeur de Perthes named the science he helped to found "archaeology." Born in 1788 in Rethel, France, in the Ardennes region, Boucher de Perthes was the son of a senior customs official who proved to be a distinguished botanist. Boucher de Perthes followed in his father's footsteps in terms of his profession, but surpassed the older man in diversity of personal endeavors. He drafted plays, wrote poetry, and outlined a theory on the soul's immortality; he traveled, taking interest in all things—even in politics—and in 1826, for the first time, thought of researching the mementos of the earliest humans while he was excavating a sand quarry near Abbeville.

Finally, in 1832, he dug up stones that unquestionably presented traces of human work. Two years later, he would write: "Despite the mocking . . . I am still searching for the man who witnessed the flood. He must be there, in the diluvium, or banks of the Tertiary era, beside the largest species of extinct mammals, for, despite [French naturalist Georges] Cuvier's opinion, man lived with them."

On March 28, 1863, the astonishing human jaw from the Moulin-Quignon quarry was discovered; the excavation of a human fossil foreseen by Boucher de Perthes more than a quarter century before had taken place. His enemies in the scientific world turned ever the more vicious.

"Fossil man, a creature of the Enlightenment, suspected of atheism, and aiming to weaken our social structure, had both political and religious England against it." Members of the Institute and of English scientific soci-

WHAT ARE TOOLS MADE OF?

There are tools made of a single material and others that are composites.

Among tools made from one single piece of material, you'll find the flaked stone tool (stone), rasp (sharpened flint or shell), dry point (wood), little bark stripper (bone), and cold chisel (iron).

Most tools, like a hammer or chisel, have both a handle usually made of wood and a metal part (like the blade of an ax).

eties met in Paris to discuss the authenticity of the remains. Finally in his report delivered on May 18, 1863, Milne Edward stated to the Academy of Science that there was no longer any doubt about the human being from the beginning of the Quaternary era.

It was a victory for Boucher de Perthes. He died five years later, in 1868, but his research was not in vain. Support grew, and the scientific study of prehistoric times quickly took on an official quality. In his careful search for the distant links to early human life, this scientist was most definitely among those ready minds for whom Pasteur said discoveries awaited.

One question arises when hearing such a story: if Boucher de Perthes did indeed recognize human work in the sharpened flint tool, the ancestor of his own knife, why had others not made the discovery before? A host of moral, historical, and psychological reasons connected to material context are necessary to the answer. First, the belief in the historical truth of the story of the Bible never inspired an exploration of an alternative: either humans were present, or there was nothing. With this kind of thinking, the oldest remains found in the ground were thought to date back to the Romans, Greeks, and Egyptians. The fact is that for objects and bones to be gathered, they had to be recognized, recognizable, and perhaps researched. Displayed in cabinets of curiosities, the flint tools were seen as enigmas or oddities of nature, and the bones were attributed to animals or humans from recent eras. Excavation work gave researchers another chance. Also, there's the bridling power of traditional beliefs: the stone axes found by working peasants and winegrowers in their fields were called lightning stones and thought to be the debris from storms (part projectile, part fusion). These relics were often buried under the thresholds of homes to protect against lightning.

A lopped-off branch machine's amoeba
A fragmented flint tool's protozoa . . .

The untooled stone sleeps inactive unconcerned
Hatching its possibilities beneath its dry body . . .

The birthing arrow returns to its target
Hits a firing pin and strikes a hammer
And logic has already shown its snout . . .

In a small bit of wood the ax finds its hole
And the liana's link alienates its flight . . .

Quite heavy metal emerges as a pruning knife
Replacement for stone material for trumpets
Strut of the dagger the kriss the dilemma
Strut of the knife the plowshare the adze

Raymond Queneau

In his six-canto poem "Petite Cosmogonie portative" ("Small Portable Cosmogony"), the French encyclopedist and poet Raymond Queneau relates the history of the world and especially the appearance of tools with verve and humor.

A broken blade can become a scraper. As they worked with stone tools, prehistoric people discovered the tools' various functions. This one is from Easter Island.

The Knife-Saw

AFGHANISTAN **Sharpened Flint Tool**

As small as it is, a sharpened flint tool shaped like a bay leaf deserves to be picked up and examined. Despite its simple appearance, it's already the multiblade knife that was to come after numerous interim forms and twelve thousand years. When used in an up-and-down motion, the blade will slice; used side to side, it becomes a scraper, indispensable for preparing skins.

And that's not all: one can drill a hole by pivoting its tip on wood, leather, or bone. The observer will also notice the tiny saw on the other side of the object, so finely toothed that it could make a definite mark on a tough material before the cutting edge was applied.

The object is so basic and essential that it was already the ideal Ginzu knife: holding only this single object, one has both a saw and a knife. Using it requires dexterity, but it is conveniently both light and manageable.

It may have once been held by an artisan-artist; its tip may have been used to engrave a design into bone—jewelry or amulets—similar to the extraordinary horse heads carved on disks cut from shoulder blades, many of which have been found in the French Pyrenees region.

The tool's small size ensures that it never had a handle, but it guarantees its solidity. It was held between the thumb and the index finger, in the way we use a single-edged razor blade.

Finally, its surface speaks to us. In minute detail, the repeating ocean waves of this unique stone's light-colored mineral surface captures our attention and imagination. The object was extracted from a block of flint, a miracle of human ingenuity. By function it is a tool, by design a sculpture. Before a stone statue a child asks, "How did the artist know the sculpture was inside?" It's true. The object is there before us, it speaks to us, and our

In Brittany, in the French countryside, "lightning stones" used to be placed in caskets. These smooth stones some times found in the ground were thought to have been produced by a lightning bolt that had struck there. In the French Aveyron region, it is believed that when lightning hits the ground, such stones will sink six feet under and will resurface at a rate of one foot per year. Families cherish these stones, as they are thought to bring good luck and ensure an afterlife. They are therefore placed in caskets, just as in Neolithic times, as excavations reveal.

Nicole Balmont, *Mythes et croyances dans l'ancienne France*
(Myths and Beliefs of Ancient France)

hands recognize it. This one speaks a twelve-thousand-year-old language that we understand better than others.

This small piece of stone is strong evidence. Created by the pressure of a percussion tool, the waves gracing its surface comply with the rules of composition. The small blade of the flint tool is unquestionably handsome. Thus, from the very beginning, the tool's efficiency, stripped to its essential elements, was destined for beauty.

Held between thumb and index finger, the flint tool can be used both as a knife and saw. Some inventions date back to the very first tool.

The Body as Tool, The Found Tool, The Built Tool

An examination of the three ways living things take action will clarify the nature of the link between the living and the tool. Furthermore, it will allow us to compare the different destinies of specialized tools to all-purpose ones.

A finch from the Galápagos Islands uses a tool to poke an insect out of a hole.

The first "tool" category consists of the specialized organs that are part of an animal's body. These are the burrowing paws of moles and crickets, the point of the beak of certain birds, the claws of crabs and bears, the wolf's teeth, and so on. Each example developed through the genetic program that has steered the animal's growth. These very well armed animals are the descendants of their distant ancestors who were characterized more by their "all-purpose" qualities. Now they owe their survival and their existence by our sides to their specialized capacities.

When considering human nails, teeth, and hands, we realize just how little specialized they are. Without the gift of the brain and the rich possibilities of its inventions, being equipped in this way is a handicap in the face of life's battles.

One can imagine the admiring and envious eye the first humans must have cast on the accomplishments of animals.

The second type—and here the word *tool* starts to be used properly—refers to the objects that animals come across in their natural environments that they take to use.

The nuthatch cuts off bits of pine bark and, holding them in its beak, uses them like levers to lift bark layers, finding the insects beneath for its nourishment.

Some apes pick up stones for cracking nuts or use a dead branch to bring a fruit within reach.

Some tropical ants build tall nests from leaves, using silk-secreting larva insects as glue. Here, the tool, which is retained and used at length, is living, used for its unlimited production of silk thread.

This series of tools clearly brings us closer to the human experience. It's very certain that the first rudimentary tools held by a man and a woman were the branch, stone, and shell that were fallen upon accidentally. The adventure of technology started here. A need is felt; the found object might help satisfy that need; the object is used and then thrown away: members of the same species will endlessly repeat this pattern, in identical fashion. For humans, however, this first experience was to be the foundation stone of a construction project

AGAINST TOOLS

You ask me to plough the ground! Shall I take a knife and tear my mother's bosom? Then when I die she will not take me to her bosom to rest.

You ask me to dig for stone! Shall I dig under her skin for her bones? Then when I die I cannot enter her body to be born again.

You ask me to cut grass and make hay and sell it and be rich like white men! But how dare I cut off my mother's hair?

Chief Smohalla, nineteenth-century Native American prophet and founder of the religion of Dreamers, Northwestern United States

that continues to grow under our eyes, thousands of years after the first wood, bone, and stone objects were found.

The third category consists of tools that were not only found but adapted to a function; they were improved upon. Animals with developed psyches, like chimpanzees, provide us with examples of such adaptation.

A chimpanzee who wants to extract the ants or termites from their mounds will choose a branch and break it to the appropriate length, remove the leaves and bark if necessary, and perhaps bend it for better results. It will then insert the branch into the anthill or termite mound, deep into the insect colony. It will leave it there until it is covered, pull it out, and quickly lick off the prey.

Chimpanzees have also resolved the problem of drinking water from a receptacle that has an opening too small for their mouths. The chimpanzee will take leaves from a tree, press them together, and plunge them into water. It will pull out the package and sip the liquid from it, quenching its thirst.

Humans, unlike animals that don't improve such a process, will take the receptacle with them to their shelter, leaving it at their disposal so that it can be used again.

The converted stone is the first tool that bears the unmistakably human signature of transformation. In view of its density (considerable weight for such small volume), its shape (the oval makes it easy to hold), and its material (it won't crumble like slate), a stone from a river or ocean makes an excellent sledgehammer or hammer. When the stone broke in two, either because it was used too roughly or because of a natural cause (such as fallen rocks, fire, frost), humans encountered a new formation. The stone could, of course, still be used for hammering, but the circular edge was to inspire people's planning side. They would see that by pushing and pulling the tool along the inside surface of an animal skin, it could be used as a scraper, removing the flesh and fat. Another discovery was soon to follow: a stone's right angle was the outline of a cutting edge. By applying pressure on this half-stone, tip facing down, a person could cut a small plant; if the object was tougher, a person could strike it, adding power by raising the stone. Pushing and pulling with the stone, moving not side to side but up and down, could coarsely cut leather or meat. This treasure would not be abandoned: it contained several tools in one: a sledgehammer, a scraper, a wedge, a knife. The concept of cutting off a part of the rounded surface to obtain a straight edge was soon to come, followed by the search for an easier stone to work with, one that would splinter in a more predictable, desirable fashion.

The Hand

We often hear it said that "the hand is a tool—the hand is the first tool," and without further thought, we find the connection to be insightful and correct. We never question these words and phrases enough.

Actually, there are only a few cases in which the hand is used by itself and can really be considered a tool. It is extremely inefficient. The hand alone can put out little energy and the weakness of its surface—the skin—doesn't permit overly repetitive action.

Opposite: **The hands of this potter are creating the outline of a hollow, round sculpture—an urn.**

What tools does the hand contain? The pliers formed by the thumb and index finger can only be used to accomplish small jobs. The hook of the index finger is mostly for delicate tasks like body care, or for scraping with the nail. The palm's and fingers' smoothing action is still—after tens of thousands of years—the "tool" of that fascinating artisan, the potter (especially because this action is accompanied by the pinch of the thumb and index finger). The hand becomes a mallet when it makes a fist at the end of the lever that is the arm, but it can only strike relatively soft materials, and not for long. When the palm of the hand is curved like a cup, it can be used as a ladle to draw water for drinking. When the four fingers curl they will form a hoe, offering the possibility of digging—but of course only into a material that is easy to penetrate, like sand. The two hands can work concurrently, which is often and naturally the case, offering other possibilities: together or apart, they can lift, pull out, break, tear. Among all the gestures and movements that our supple and flexible hands can accomplish—including those mentioned above—there is one that we readily forget. It is so ordinary, almost passive: the act of holding—when the hand wraps around a small object, forming a cylinder with its four fingers folded over the hollow of the palm and is closed when the thumb joins the tip of the index finger. This empty tube—which can also be considered a vise—will be the mainspring, the keystone, the essential link of that ensemble of elements that constitute man or woman at work: the brain, the eye, the lever of the arm, the hand, the handle, the blade.

The epidermis is fragile; the hand isn't armed like the claw of a bear or a badger, and it is short. Realizing this weakness, these handicaps, one wonders what a human is to do. The answer is: borrow from the material world. Employ the stone's resistance to striking and the extra length and leverage a branch can provide, appropriating these objects to conquer the very material from which they come.

This "turning against" principle is not unique; sumo wrestlers use the thrust of their opponents against them, and aeronautic engineers fly successfully when they have accepted that the aircraft is heavier than the air.

It does seem that the founding act of the entire history of human technology rests on the gesture of taking two objects (the stone and the branch), which together form a successful balance of mass, shape, and material. People were to hold them in order to use and guide them. Long after, humans, makers of tools, would combine the sledgehammer-cutter and club-lever to create the ax. With the new needs that developed, other, more specialized tools would appear, built from the same principle.

The hand cannot be detached from the living body, and therefore cannot be put away with those inanimate objects that are tools. But it provides countless possible and universal movements simply with the elementary function of taking, from the end of an energy-providing arm, which itself is moved by the body, its weight, and momentum.

Skill and the Work of the Hand

Working the hand is know-how, a way of going about properly completing a stage of a job. It's something that is passed down to beginners and is taught by demonstration. This knack, this "art of doing" goes unnoticed by the observer, who won't know that a carpenter is applying only very little pressure to the plane. The plane works through the weight of its beam and each passing only removes a layer the thickness of a sheet of paper; so it's enough for the carpenter to "walk" the plane, making it come and go.

Reapers don't always circle around when striking plant stalks. Rather, they save their energy and blades, constantly making sure to slice the tool diagonally, keeping it above the ground to reduce the risk of damaging it by hitting a stone.

Watch a blacksmith hammering a nail into a horseshoe, and you'll see him strike the head of the nail, first very neatly, perpendicularly. Once the nail has been driven in a bit, the artisan will guide it, correcting any shifting a previous stroke may have caused. The final hammering is strong, rapid, successive; its purpose is only to embed the now properly directed nail. Such a simple process requires experience and sensibility, for the power of each stroke must correspond to how far in the nail has been driven and the length of each phase must be gauged—a crooked nail will have to be removed.

Lumberjacks and carters using cant hooks and quarrymen using levers know that the proper handling of very heavy tools—a mistake would be extremely dangerous—doesn't rely on energy or strength, but on the tool's proper positioning, on a keen sense of center of gravity, and on changing balance, all of which are put to use at the right moment.

The assistant holds the horse's hoof and stabilizes the horseshoe, while the blacksmith drives the nail.

The hand's knack is something in addition to the obvious gesture; it's extra management of exerted power, an angle, softness—hardly anything at all.

This addition softens a brute action, modifies it, makes it successful. It is comparable to the microscopic drop of oil that the clockmaker places on the movement of the clock, to the catalyst that triggers a reaction—disappearing in the endeavor. This is the mystery of the hand at work.

Frankly, it's too simple to think that any individual could pick up a hammer, strike it down blindly . . . and succeed. The movement is indeed elementary. But something that is repetitive, that requires attention, awareness, and a sense for movement, for its spare quality and weight, is what is known as dexterity.

On another level, something else completely, there is Skill (I capitalize the S because it is a supreme talent). Sometimes those who have it keep it a secret. They hide their golden hand, only bringing it out when a particular need makes itself known. Those who see it at work think they are witnessing a near-impossible feat, the success of which is lucky. The comrades of skill that I am thinking of (for I am not talking about surgeons and carpenters) are folk who appear when you need them. They are somewhere, and something has happened. They are willing to work. They'll take a look. Modestly, they examine, think, and agree to try. They bring their hand into the scene, succeed, and leave.

Here a story has to replace study; what has been seen cannot be scrutinized:

One morning in a provincial town, I had to stop by the pharmacy on my way to school. A crisis was taking place: the pharmacist was holding the hands of a young, bawling child, begging her to stop rubbing her eyes. It was only dust—it would be taken out, but first it had to be found. "I can't do it. But I know someone who can; he stops by every morning."

Two minutes later, the pharmacist, pacing at the door, grabbed his punctual friend by the sleeve. A lawyer.

"Dust in the eye! Of course. Oh yes dear, I know how much it hurts," he said compassionately. "It'll all be over in a minute. Turn toward the light. Turn. Good."

He took out a pack of cigarette papers from his jacket pocket, removing a sheet

with his fingertips. Out of this fragile and impalpable object, in one swoop, he made a small roll, the size of a match. "All right," the man said in a soft voice. With his thumb and index finger he pulled her eyelids apart. "Look down." He looked up top. Nothing. "Now, down. Ah! I see it. Don't move."

The tiny tube quickly passed before the upturned lid. The young girl continued to suffer but the man in gray showed her the small roll. "This little black speck is what was hurting you. Even after it's gone, it always feels like the dust is still there. It's an illusion. In fact, it's all over."

Opposite: **Many trades require skill. This one must also be combined with speed.**

He shook hands with those around him, wished everyone a good day, and disappeared.

I had just witnessed this famous talent at work.

I carefully examined his hands, expecting that the explanation for his skill could be found in their shape, which I thought would be unique (long, slender fingers) or perhaps remarkably agile. This was hardly the case: they were massive without being thick, and their fingers were hardly separated from one another. Not quite "paws," these hands moved bulkily, as if they were covered in mittens. Skill must therefore have come from something else.

Overleaf: **In the potter's district of Cairo, the ground is piled with fragments, fire rages within the structures, and smoke blackens the sky.**

The way he performed his examination, perhaps? The man had carefully prepared his field of view, orienting the face of his patient toward the light, making sure not to create a shadow. He refused to take the magnifying glass that was offered to him and placed his glasses on his forehead. This way, he could see better. Then, after having scrutinized the inside of the lid, carefully, and having spotted the tiny black speck, he went right to it—in one single motion.

When we try to explain the skill involved in shooting—whether with a bow, as is common among Zen-practicing Koreans and Japanese, or with guns and rifles in the hands of champions—words come to us immediately: locking, concentration.

To eliminate any trembling and shaking, the body needs to lock in place, turn rigid. And it must do so little by little: first the legs, then the trunk, shoulders, neck, and finally, the arms, holding up the rifle or pulling the bow, until the eye finds the center of the target; total mastery of the body's steadiness. Now the shooter is solid and will move only a finger to the trigger to activate the projectile. If necessary, shooters wait until their hearts are beating normally, and hold their breath for a couple of seconds.

A skillful gesture is bolstered by these preparations. Now it is necessary to decide to launch the movement, not waiting too long, so that the body doesn't freeze and tire, so that tension doesn't dwindle. Finally, to give the movement a precise direction, it will need the perfect amount of force. Through habit and after much practice, the body knows how much power a stroke needs. This is the body's wordless memory, uncharted by time, and yet used with fine gradations.

The rest comes from concentration: when you thread a needle, you see nothing but the needle's eye. For skillful people, there are no fumbling, feeble attempts; there is simply an approach. Once it is certain that the connection will be properly made, the gesture is quickly completed and the operation is successful.

Because performing new tasks comes easily to skillful people, they like to do it elegantly, especially with very little. They make do with common tools that are simple, solid, and well maintained. Their luxury is possessing only the bare essentials, simplifying, rejecting the nuisance of complication. What others expect from a specific tool, they do on their own, tapping their talent. And they never lose this ability. In fact, a skillful being is one who dares to try what others shy away from or have given up on. Success builds confidence, and skill breeds its own progress and variations.

Then the Lord Yahweh shaped the man from the dust of the ground and breathed into his nostrils the breath of life. Thus the man became a living creature.

—Genesis 2:7

The Potter

The Bible presents God, creator of man and woman, as a potter; and scholars stress that the Hebrew word meaning "to shape" is the same word used to describe the work of a potter.

Perhaps the comparison can extend beyond the simple gesture of shaping. There is also the actual clay worked by the potter, from which she is made and to which she will return; the soil, whose name in Hebrew, *adama*, is at the root of the universal name for "man" as well as the name of the first man, Adam. As an empty receptacle, ready to be filled with a liquid or food, a pot fires our imagination—if a pot were to come to life, could it not hold a spirit, a soul, like the breath that was received back in the time of the first garden?

The theme of a God-potter existed throughout the ancient Orient. The idea of shaping a living creature from the most common and modest of materials—the element upon which we tread daily—fills us with wonder. The relationships between the Creator and his or her creatures and between potters and their vases are similar. Both are characterized by the creation's total dependence on its creator. Don't potters reuse their unsuccessful vases? They crush them, reduce them to a shapeless mass, and throw them into the clay pile. In like fashion, a pot that has cracked in a too-hot kiln must be thrown into the garbage because it is hopelessly broken. A defective pot is not fixed. In Japan, however, illustrious masters bless cracking as the mark that will turn their tea bowl into a sought-after, unique piece. Sometimes the imperfection will be magnified, sanctified, and rendered even more precious when these living national treasures dribble a few drops of fine gold into the cracks.

Curious children who are taken to a potter are understandably amazed by what they see. So much happens with so little that children may think they are witnessing a magic trick or an illusion. How can it be that a slab of soft clay on a round, spinning surface, with the guidance of a mere two hands covered in dried clay, will all of a sudden become a pot that is even the slightest bit solid?

Clay is strikingly elementary, and the gestures used to shape it into a pot are remarkably simple; people have hand-produced this essential object for so long that someone visiting the potter actually steps out of time. Was it not this same clay that the Sumerian scribe used to engrave the story of the Deluge? Was it not a receptacle that held the Nile's water, the liquid crucial to the survival of pyramid builders? Was it not a round urn that held the ashes and bone fragments of Roman citizens? The potter's invention dates back to the distant Neolithic era.

The potter's slender hands command all four ele-

> The potter is buried alive. He tromps through mud more than a pig does in order to find clay for his pottery. His clothes are stiff with clay, and his belt is tattered; if air enters his nose it quickly becomes fire.
>
> **Satire of the Trades, ancient Egypt**

THE POT OF CLAY AND THE POT OF IRON

Pot of iron to pot of clay
A journey suggested. . . .

Off they went, my three-legged friends,
Hobbling as best they could,
Against each other they were tossed
By the least little bump they encountered.
Pot of clay bore the pain: not yet gone a hundred steps
His companion crushed him to bits
While he had no cause to complain. . . .

Jean de La Fontaine

ments: earth will become the pot, water will give the clay its elasticity, air will dry the fresh creation, and fire storms in the kiln. The thick mud has been graced with the finesse of shape; although it is fragile, the object will prove to have an incredible capacity to survive, even when cracked: the fragments will neither rust nor disintegrate in saltwater or ground. They are what will tell of past civilizations long after they have disappeared, allowing us to date them.

Not all potters had or have a wheel. In the past, some civilizations performed brilliantly in many areas without ever knowing the wheel; and in our time, the large vats and crocks that are too thick and heavy for a wheel are shaped in the same way they were in ancient times.

The technique is simple. Potters place a rounded, thick slab of clay on a flat surface. This will become the bottom of the receptacle. Then they will roll a clay rope and coil it around and around this base in a spiral. Potters pinch and smooth as they build the form until reaching the neck, which will complete it. In sum, the artisan has shaped a hollow sculpture.

The process is different when a wheel is involved. With it, artisans use centrifugal force, one of the simplest rules of physics, to their advantage. This dynamic will pull any object placed on a rotating circle away from the center. The wood turner's wheel (with a horizontal axis) is used differently, despite its appearance. Centrifugal force isn't at play when the woodworker shapes a chair leg, because wood is solid. When the gouge or wood chisel contacts the spinning wood, it will adopt all kinds of shapes around its circumference.

To clarify the concept with a comparison, one might say that saws create planes, gimlets bore round holes, and wheels can produce only cylinders and their derivative forms.

The potter's wheel proves that any kind of rotation will produce—with help from tools capable of removing clay—a tube-like structure. But there is also the centrifugal force at work on the soft clay, which pulls it strongly to the outside of the wheel's throwing platform. Turning at too high a speed, the wheel could very well fling overly watery clay onto the wall of the potter's studio. With properly solid clay and a moderate speed, potters have a perfect beginning. Centrifugal force applies its horizontal pull throughout the clay or outline of the pot, pushing the pot toward the potter's hand. The potter counteracts this force by pushing the clay up, inch by inch, along the outside of the vessel.

How you turn things upside down, as if the potter ranked no higher than the clay! Shall the thing made, say of its maker, "He did not make me"? Shall the pot say of the potter, "He has no skill"?

—Isaiah 29:16

The basic process is as follows: first, one must properly consider the amount of clay needed; then, imagine the inside of the pot and form its bottom from the clay. Subsequently, one begins to create the sides by pinching the clay, turning it upward, and bringing up the ring of clay surrounding the base,

I roused one from the north, and he obeyed; I called one from the east, summoned him in my name, he marches over viceroys as if they were mud, like a potter treading his clay.

—Isaiah 41:25

keeping an eye on its width by passing a finger inside. In the end one has a receptacle, its heavy base acting as a stabilizer while the even walls distribute weight. The ring around the neck serves as a buffer.

The new "creature," still a bit soft, is removed from the wheel's tray with help from a piece of wire that is carefully pulled across the bottom with both hands. It is then placed on a large tray to dry by air or sun. Air is the potter's ally and will gradually draw out all the remaining water from the pores of the clay.

Once the artisan has enough dried pots, she will carefully arrange them in the kiln, which is shaped like a vaulted cave and lined with refractory bricks. Wood is stacked up inside, and the fire is lit. The amount of time the pots spend in the kiln depends on their thickness and number. For polychrome earthenware and pottery, between 1100 and 1700°F is required, and between 1800 and 2400°F is needed for stoneware. The heat of the wood kiln—which dates back to the Egyptians—was controlled through a window in its wall and estimated by the color of the flame. To monitor porcelain, which is very fragile, potters use porcelain cones as testers: the slump of the cone inside the kiln indicates its temperature.

The door is opened and the kiln is left to cool. First the ashes are removed, and then the pots, all in time for the next load.

Matters were made easier when electric kilns came along, with their accurate thermometers. Wheels, too, turned electric, equipped with precise settings that saved the potter from exhaustion. The first simple wheel was used by third millennium Egyptians, evolving into the Greek wheel of the third century BC. Then there was the spoked wheel moved by a stick, and finally the double wheel; the potter's feet spun the lower wheel.

The simple, flexible cut-off wire, with wooden handles at each end, is used to take a hunk of clay from the pile and to detach the pot from the wheel's center. Aside from this wire, however, the potter doesn't use many tools.

The potter's rib is a small, rectangular shingle of wood with a hole at its center. It will give the pot its necessary curve once its basic shape has been formed.

The trimming tool is a simple wooden handle with a wire triangle on one end used to empty the inside of the pot while it is spinning, thinning the walls at the same time.

The "scarifying" tool, a metal triangle attached to a wooden handle, will mark grooves.

At the Turin museum you can see a Greek vase that presents Athena, goddess of mechanical intelligence, crowning a potter.

Opposite: **An Indian potter from Karnataka alternates between spinning the wheel and working the clay.**

> For a potter kneading his clay laboriously molds every vessel for our use, but out of the self-same clay he fashions without distinction the pots that are to serve for honorable uses and the opposite; and what the purpose of each one is to be, the molder of the clay decides. And then with ill-directed toil he makes a false god out of the same clay, this man who not long before was himself fashioned out of earth and soon returns to the place whence he was taken, when the living soul that was lent to him must be repaid.
>
> **Wisdom of Solomon 15:7–8**

Where the Multitude of Tools Meet for the First Time

The Hardware Store on Main Street

The prudent storekeeper will present only what is new, fashionable, or seasonable in the store window. The rest—all and sundry—is saved inside. Seriously but triumphantly, the storekeeper can announce "I believe we have it in stock." But the pronouncement is cautious because the store is packed full of items, and finding the specific one in question, which he has passed ten thousand times, may be a challenge.

The merchant took me through his place of work. A desk, records, bills. He laughed, "We have a large variety of tools here. I've never counted, but there must be twenty-five hundred different kinds of objects. I sell some of them by the piece—maybe not the little nails (I give them away, it's faster)—but the bolts and faucets. And I don't have everything. We could double our stock. Look."

He took out a heavy book with spiral binding from a pile; a tool manufacturer's catalogue. I flipped through: infinite varieties of pruning shears, pruning knives, spades, and so on. Amazing! And this was nothing; there were just as many for ironworking, woodworking, and construction. . . .

And these were just on paper! We got ready to dive into his inventory. Soon we were making our way through drawers; it looked like a map of New York City, with its grid of streets and avenues, tiny on top, heavy on bottom. The ladder slid along a horizontal rail. Brass handles, wooden buttons; samples of each article hung on a small wire loop from the front of the drawer. The merchant finds, the customer examines. How marvelously simple!

With all the dreams and plans it inspires, a hardware store is like Ali Baba's cave. French hardware store.

Never mind index cards, records, identification numbers! Because the objects are grouped by family, according to a rigorous logic, one can feel if one is close to one's goal or not—like in a child's game of "hot-cold."

A customer appeared. The shopkeeper knows his tools, from the inside out. He spoke of the quality of one tool in comparison to another, asked about the kind and scope of work that was to be done, and confidently decided in favor of one of the two saws.

Who wouldn't daydream in a tool store? Our imaginations run wild. The beams are sharpened like pencils, or ruffled like feathers, or lined up like dominoes; stones fall into line like soldiers, iron is as malleable as modeling clay. A life of labor flashes quickly by and seasons intertwine in the store's vines.

The man sees my gaze. He has seen it many times before. He knows that the variety of tools speak not only to our hands but to our minds that picture them in action. They hold our attention—whether familiar or unknown—and wake up the doer who sleeps inside most of us; as if the tools wanted to come alive, to serve, to get to work.

Gulliver Among Tools

A giant among dwarfs, a dwarf among giants: Gulliver is the adventurous hero representing the world's relative scale.

In our everyday world, we live like Gulliver, in his world. Signs fit for the eyes of giants hang everywhere in the streets of our towns and cities: the tailor's scissors, the cutler's knife, the blacksmith's hammer, the giant baker's shovel.

In our daily lives, we come across a thousand testimonies of our love and respect for tools. They are exact replicas, down to the smallest detail; an approximation would be useless. In fact, they are here because their form is true. They are present. Who would want an imprecise, vague boat model?

Here, progress is made on those workshop models, those toy shops created for the education (and fun) of princes, like the ones that can be found in museums. There will be wood chisels as big as a thumbnail and pincers as long as a sewing needle, each carefully put away on the rack.

For especially inquisitive visitors wanting to see everything, stores that offer Mexican popular art objects would stock perfectly reduced blacksmith masterpieces: tongs and inch-long blue-steel shears. Their purpose, it seems, was to offer the pure and simple pleasure of wonderment that is gained from a miniature. Nonetheless, these Lilliputians were indeed tools.

In Lisbon, near the port, a jeweler sells silver reproductions of tools as pendants. He has them all, scissors, hammers, axes, pincers, saws, planes. Eventually, he will sift through them all—some are talismans, good-luck charms, but others are not (nobody knows why)—and offer to a young mason the possibility of giving his beloved a silver trowel to wear around her neck as a sign of faithfulness and loyalty.

In our time, French pastry chefs add a magic touch to their Christmas Yule log cakes, a trinket that would help slice the log if it were real: a tiny pink saw, a small green hatchet, or a brown billhook, each one made of plastic and no longer than a pinkie.

Opposite: **Giant tools as store signs, miniature tools around the neck worn as talismans—tools are by our sides throughout our lives.**

At the foot of a wall they're opening a trench;
The laborers, bare-armed and head bent low,
Come and go, digging through the darkened shaft,
Underneath the pickaxe, looking like a blackbird's beak,
Resonates the rock, as does the iron in the forge.
Victor Hugo, "La Legende des siècles" ("The Legend of the Ages")

Tools in Literature

Tools and the idea of working with the hands often arise in literature as fact and as metaphor. French poet Victor Hugo understood human movements and the forms of tools, and felt the ambiguity of their usage; sometimes we are peaceful builders, sometimes menacing murderers.

God, the great steelworker
with his black hammer.

Victor Hugo, "Les Quatre vents de l'esprit"
("The Four Winds of the Spirit")

Man is a tool-using animal. . . . Without tools he is nothing, with tools he is all.

Thomas Carlyle,
Sartor Resartus

A worker may be the hammer's master, but the hammer still prevails. A tool knows exactly how it is meant to be handled, while the user of the tool can only have an approximate idea.

Milan Kundera,
The Book of Laughter and Forgetting

Let a human being throw the energies of his soul into the making of something, and the instinct of workmanship will take care of his honesty.

Walter Lippmann, *A Preface to Politics*

The irregular and intimate

What are they forging there, those two dark blacksmiths?
Are they making a plow, are they making a sword? . . .
Be it double-edged sword or plowshare, their work is the work of God himself.
Victor Hugo, "Dernière Gerbe" ("The Last Sheaf")

No man who is occupied in doing a very difficult thing, and doing it very well, ever loses his self-respect.

George Bernard Shaw, *The Doctor's Dilemma*

Whatsoever thy hand findeth to do, do it with thy might; for there is no work, nor device, nor knowledge, nor wisdom, in the grave whither thou goest.

Ecclesiastes 9:10

"You, the people every day and all week long,
You must to work! Take the tool in your coarse hand,
Pave the ground, mold the iron, drench the steel,
Forge and dig, build and labor, shovel and delve;
On Sundays, love and dance, and laugh your heart out at Bobêche!"

Victor Hugo, "Les Années funestes" ("The Fatal Years")

**The miner's pickaxe,
the poet's verse,
Dig deep into the same
enigma seeking
the same gold.**

Victor Hugo,
"Les Quatre vents de l'esprit"
("The Four Winds of the Spirit")

quality of things made entirely by the human hand.

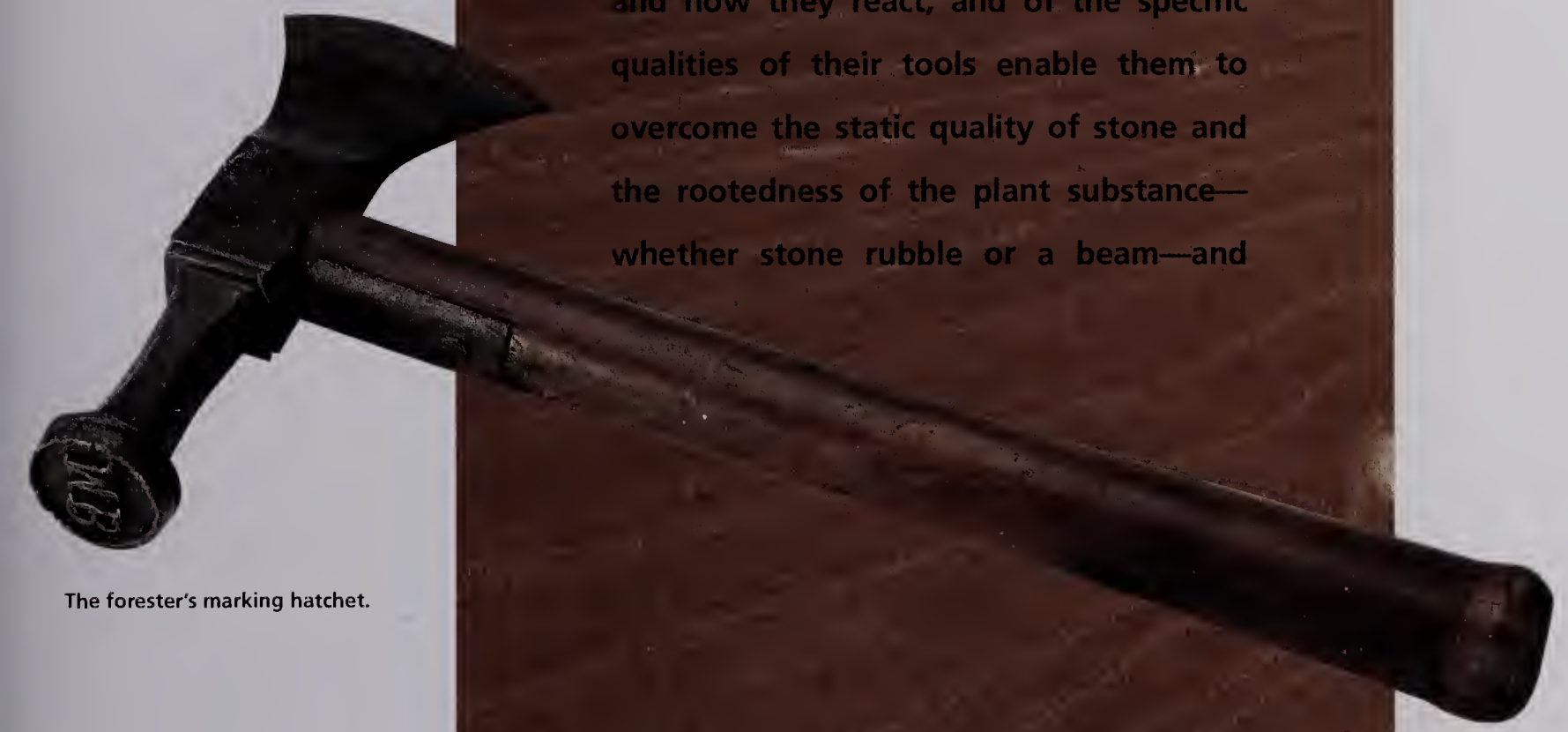
Willa Cather, *Death Comes for the Archbishop*

A man at work, making something which he feels will exist because he is working at it and wills it, is exercising the energies of his mind and soul as well as of his body. Memory and imagination help him as he works. Not only his own thoughts, but the thoughts of the men of past ages guide his hands; and, as part of the human race, he creates. If we work thus we shall be men, and our days will be happy and eventful.

William Morris, "Useful Work versus Useless Toil"

WOOD

The tasks performed by a lumberjack to remove a tree from the forest—to take wood from nature—can be compared, in principle, to a stonecutter's. Both jobs involve taking on a material that is too dense to be usable otherwise. With tools, humans break such materials up so that they can do with them what they want. Their knowledge of textures, of materials and how they react, and of the specific qualities of their tools enable them to overcome the static quality of stone and the rootedness of the plant substance—whether stone rubble or a beam—and



The forester's marking hatchet.

make them usable. We are very familiar with this process. We practice it every day when we eat, as we cut up meat or slice or break bread from the loaf. It's a matter of simple logic for, piled up and arranged, blocks of stone become a house. We would laugh at someone who tried to dig a dwelling out of a quarry by hollowing out its interior and surrounding area.

Opposite: **Lumberjack at work in the Vosges Mountains of France.**

The Sequence of the Lumberjack's Tools

> I wish all to know that I do not propose to sell any part of my country, nor will I have the whites cutting our timber along the rivers, more especially the oak. I am particularly fond of the little groves of oak trees. I love to look at them, because they endure the wintry storms and summer's heat, and—not unlike ourselves—seem to thrive and flourish by them.
>
> **Sitting Bull,**
> **Sioux chief**

Before it became a log in a fireplace, a plank in a table, or the frame of a house, every piece of wood was part of a living tree standing in a forest, with its imposing trunk, head of foliage, and invisible roots digging their way through the dark earth.

Far from being a wild jungle, this forest is a managed and cultivated space, maintained like a vineyard or a wheat field, though less obviously so. Indeed, the life of the forest is not measured in years corresponding to the periodic recurrence of harvests. Trees take a long time to grow, and a person who plants one the day a child is born knows that the child will not be the one to enjoy it.

Forest owners think in terms of periods of fifteen, twenty, or fifty years. They keep bushes, vines, and other parasitic plants from stunting the trees' growth. They make sure that the large trees don't harm each other by blocking the sun or tangling their roots.

From time to time, the farmers decide to fell a section based on a combination of factors: profit, maintaining the forest balance, and concern for harvesting the trees when they are at their peak of quality, before they start to age and begin their downward curve.

Once the decision has been made to cut down a tree, the first tool to be used is the forester's marking hatchet. It serves a double purpose: the blade on one side is used for cutting off a small area of bark where a painted mark will be applied. The other, the hammer side, contains a brand that is stamped onto the wood. Once a tree bears this mark, it is ready for the lumberjack.

Lumberjacks widen the narrow path left by a saw by driving wedges into it.

The lumberjack's first step is to determine the best direction for the tree to

fall. A natural empty space is ideal; if the tree falls into this space, it will avoid damaging the surrounding trees. Once the decision has been made, two lumberjacks clear branches, shrubs, and bushes from around the trunk.

To do so, they use a billhook, a cutting tool with a broad blade and short handle that is actually nothing more than a simple grip. There are many kinds of billhooks. As a rule, the tip of the blade is hooked, enabling users to use it to pull branches toward them. Some billhooks have a rudimentary rectangular blade. Unlike the hatchet, the billhook is used to cleanly cut small branches with a short motion requiring little force. Due to its curved "beak," the billhook is unsuitable for use on the trunk.

The billhook, which is wielded with one hand, looks like a long cleaver with a hook on the end.

An ax can also be used to trim small branches (on a log, for example), or to prune the length of the trunk by swinging it away from the body. Designed to chop a trunk, the ax—which can be seen as a sharpened wedge placed on a handle to take advantage of the effects of leverage—moves with small blows and scatters wood chips all around. Larger than the household hatchet, it has a handle about three feet in length. Its edge is curved, while the edge of the felling ax is straight. Depending on the work to be done and the habits of those who use the tool, the handle will be slightly curved or even have a double curve, as is the case with many North American axes. The handle is made of

Whoever is the first to busy his hands
At cutting you, forest, down with a crude ax,
May he impale himself on his own rod,
May he feel Erisichton's hunger in his belly, . . .

Listen, lumberjack, lower your arm for a bit,
These are not logs you are throwing down;
Don't you see the blood that keeps on dripping
From the nymphs who once lived below the
hardened bark?

Pierre de Ronsard

One-handed tools, two-handed tools—this saw is operated by four hands in a back-and-forth motion.

beechwood, which is prone to break under very heavy blows; chestnut, ash, or locust are considered the most supple woods.

The billhook and the hatchet are one-handed tools, like the knife or the cleaver. Other tools must be used with two hands. The ax lies somewhere between. For light work it can be held in one hand, even by gripping the handle in the middle. However, if it has to be used for heavier work or if it needs to be swung, the ax must be grasped with both hands.

The felling ax—a large, heavy ax with a long blade and a fine, asymmetrical cutting edge—belongs exclusively to the second group, as it must be used with two hands. It is extremely well suited to chopping down broad-leaved hardwood trees. There is a special way to handle it, though this naturally tends to escape the eye of the observer. When lumberjacks raise a felling ax far over their heads, if they are right-handed they place their left hand on the base of the handle and the other hand not far from the ax head. As the tool begins to descend toward the trunk, the right hand slides toward the left and the base of the handle to further reinforce lever-

THE FOREST AND THE LUMBERJACK

A Lumberjack had just broken or mislaid
The wooden handle of his ax.
This loss could not be replaced so soon
Which gave the Forest some time for repose.
Finally the Man humbly implored her
To let him very gently
Take away one single branch
So as to make another handle:
He would go elsewhere to earn his bread;
He would leave standing many an oak and many a pine
Whose age and charms were respected by all.
The innocent Forest provided him with other arms.
She lived to regret it. He fixes his steel:
The wretch uses it merely to
Strip his benefactress
From her most important ornaments.
She moans, does not cease moaning:
Her own gift leads to her demise.
Thus, too, the ways of the world and its factions:
Good deeds are used against the benefactors.
I am weary of discussing this. But with so much gentle shade
Exposed to these affronts,
Who would not lament such happenings?
Alas! I can howl all I want and make myself impossible,
Ingratitude and all abuse
Shall not be less in style.

Jean de La Fontaine

age and the swinging effect. Like the regular ax, the felling ax can be used to cut down a small tree. When working on a larger tree, the felling ax would be used to cut a channel around the base of the trunk. By doing so, the woodcutter reduces the diameter of the area to saw and eliminates the wood fibers whose angle make them hard to cut.

Unlike the felling ax, the sledge ax is a broad wedge with a sharp edge on one side of its head. The cutting blade is used to split firewood cut on site by the lumberjack. The other side will be used to strike wedge heads to fell the tree.

The wedge, a heavy piece of beveled wrought iron whose head is deformed by blows, has a twofold function when the tree is cut down. By placing several wedges in specific positions, the woodcutter can precisely control the direction in which the tree will fall; wedges are also placed behind the tree to keep the blade of the saw or the chainsaw chain from becoming stuck when it cuts. Wedges were initially made of iron, then steel, until it was discovered that the metal shards they produced were very dangerous. Wedges made of light alloys exist alongside the traditional wood wedges, which are driven using a maul, a heavy, long-handled mallet. The two heads that contact the wedge are bound by a metal band.

There are two general types of logger's saws. The first are frame saws, which operate on a simple principle: the blade is kept taut by a cord on either side of the wood saw, or, in modern metal saws, by an arch of metal tubing. In both cases, the worker grasps and wields the tool by the frame. This type of saw is good for working small unfinished logs up to about eight inches in diameter.

The Swiss painter Ferdinand Hodler shows a lumberjack lifting his ax. *The Lumberjack*, Museo de Arte, São Paulo, Brazil.

THE LUMBERJACK AND MERCURY

A lumberjack had lost his livelihood:
This was his ax; and as he vainly searched for it
It was pitiful to hear him on the subject.
He had no other tools to sell.
All that he owned depended on this one alone.
Not knowing where to place his hopes,
His face was fully bathed with tears.
"Oh, my poor ax! oh my poor ax!"
He called out loud, "Jupiter, please give her
back to me;
I hold it to be another of your blows." . . .

Jean de La Fontaine

There are many types of double-handed crosscut saws. They are the simplest saws in the world—they all share a long (up to over six feet), wide (four to eight inches) blade equipped with two small vertical grips. Their overall shape varies. Some are shaped like a ribbon, while the teeth of the other describe a convex curve. The teeth can run the gamut from a series of simple triangles to a more complicated pattern with curves and reverse curves; sometimes two oblique teeth surround another one placed on the blade axis. Of course, these saws are operated by two people, one of whom pulls while the other pushes. The saw's grips can be removed to make it easier to take the blade out of the cut, if necessary.

Stripping the bark from the trunk is a job that varies from season to season. The bark is hard to remove in the late winter because the flow of sap makes it less flexible. The job is performed with a very sharp iron trapezoidal or kite-shaped bark spud, which workers push away from their bodies while holding the middle of a long handle.

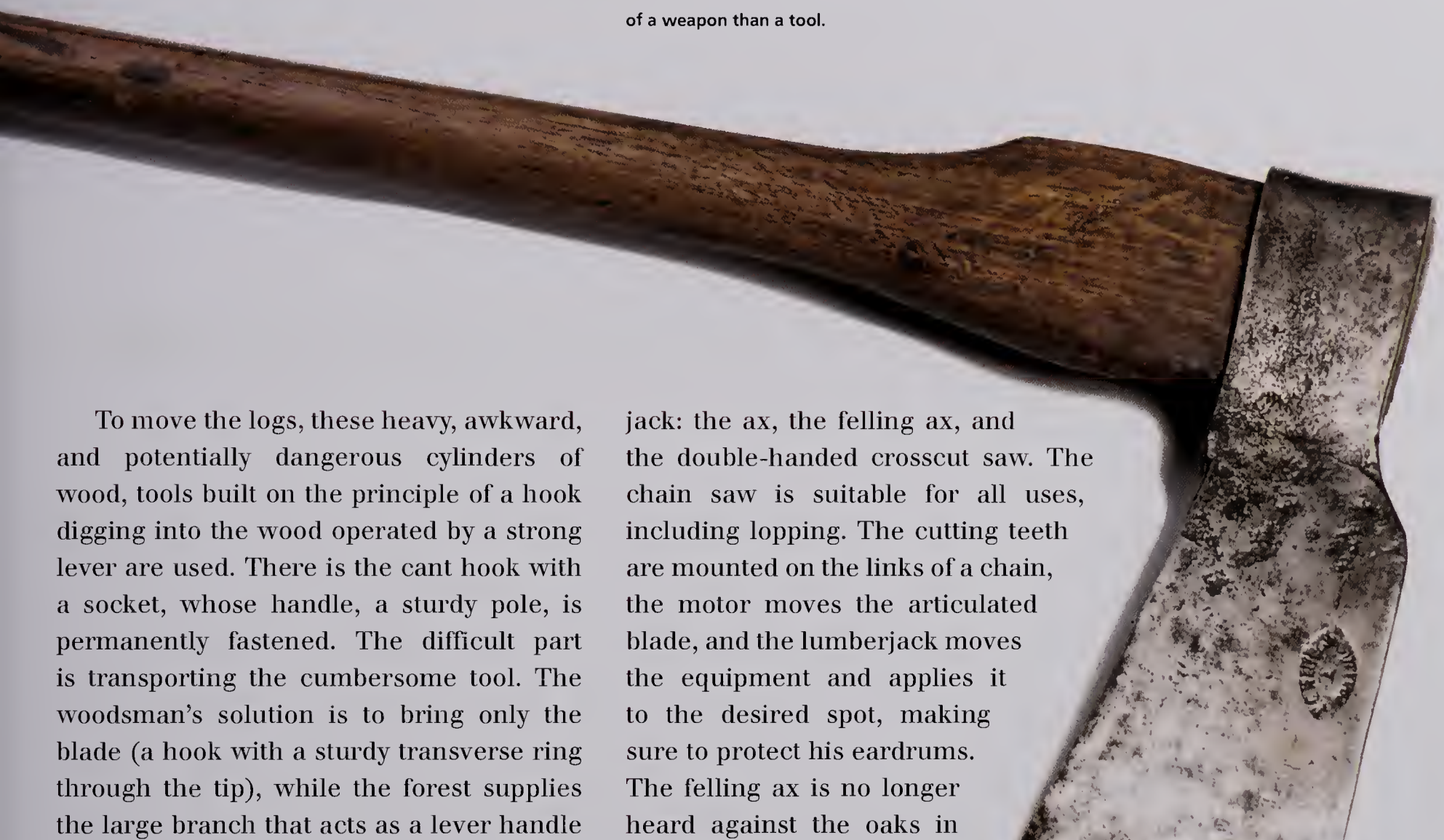
Many years ago, the bark was worked with one of the most rudimentary tools in existence: a simple cow bone beveled on one end and held by the socket. It excelled at its job of separating the bark from the tree without cutting into the wood. Those who used it experienced a particular satisfaction. In part, this satisfaction certainly stemmed, in a vague sense, from gratification from the idea of this meeting of animal and vegetation (blade wounds wood), though surely also from the pleasure of ingenuity, of the modest victory felt at the act of reclaiming something and putting it to use. In the country, there is a tradition that nothing goes to waste. A three-forked trunk becomes a chopping block, a marrow bone is used as a keyholder for the large barn door, bark is taken to the tannery, the clippings from horse hooves are sold as fertilizer, and so on.

On site, lumberjacks made sure to bring along what they needed to sharpen their cutting tools. For the felling axes, axes, bark spuds, and billhooks, most sharpening was carried out on the center of a pedal-operated round grinding wheel with a sawhorse in the shape of an inverted V; on top was a container for the water to moisten the stone. A whetstone was used to finish the job.

A three-square file was used to sharpen saw teeth, before the introduction of the saw-set made it possible to put an edge on both sides of the blade alternately.

The branches of the felled tree were stripped using a billhook or an ax, while a saw was used to remove the smaller branches, to reduce it to the longest possible stripped cylinder, which the crosscut saw could cut into sections.

The long-handled felling ax, which is used with two hands, is more of a weapon than a tool.



To move the logs, these heavy, awkward, and potentially dangerous cylinders of wood, tools built on the principle of a hook digging into the wood operated by a strong lever are used. There is the cant hook with a socket, whose handle, a sturdy pole, is permanently fastened. The difficult part is transporting the cumbersome tool. The woodsman's solution is to bring only the blade (a hook with a sturdy transverse ring through the tip), while the forest supplies the large branch that acts as a lever handle once it is pulled through the ring. Lighter than these are the pickaroon (piked pole) and the cant hook, both of which are simple hooks, though the pickaroon is equipped with a caliper with a transverse wood grip, and the cant hook has an oval iron grip that is a flat continuation of the curve of the hook.

The sappie, a type of peavey, is an example of a tool that traveled. The hook, shaped like the beak of a bird of prey, was imported to France by Tyrolian lumberjacks around 1935. It is used to pull or turn the trunks.

Once the logs are moved, another story unfolds. When they reach the last place that harnessed horses can get to, the next part of the process begins. This consists of removing the timber from the forest to transport it to a road suitable for motor vehicles.

In the twentieth century, the portable power saw, or chain saw, has replaced the three tools that are symbolic of the lumberjack: the ax, the felling ax, and the double-handed crosscut saw. The chain saw is suitable for all uses, including lopping. The cutting teeth are mounted on the links of a chain, the motor moves the articulated blade, and the lumberjack moves the equipment and applies it to the desired spot, making sure to protect his eardrums. The felling ax is no longer heard against the oaks in the forest; you can admire it at folkloric competitions and celebrations but the money to be made in cutting trees has increased manyfold, and the traditional ways of the lumberjack's profession are mostly a memory.

Overleaf: **Lumberjacks at work in the Ivory Coast.**

EXPIATION

Thus a whole army was lost in the night.
The emperor was there, upright and watching,
He was like a tree about to be felled.
Misfortune, ominous lumberjack, had climbed
This giant tree, whose grandeur until now was spared;
And he, a living oak, offended by the ax,
Trembling at the ghost of a gloomy revenge,
Watched as his branches fell all around him.

Victor Hugo, "Les Chatiments" ("The Punishments")

THE CRIMINAL'S AX

The student Raskolnikov, the protagonist of Fyodor Dostoyevsky's novel *Crime and Punishment*, has decided to kill a moneylender with an ax. The domestic tool used to chop firewood in the building's courtyard thus becomes a weapon the reader can envision inflicting horrible wounds—all the more because the person obsessed with the idea is an amateur.

Like a film director who manages to lend an object the haunting quality of an existence through camera movement alone, Dostoyevsky, adding to our horrified fear, makes the ax a virtual character from the beginning of his novel.

He prepares carefully: "As for the loop, it was an ingenious invention of his own: the loop was meant for the ax. . . . Now he had only to place the head of the ax into the loop and it would hang peacefully under his arm for the entire journey."

The tool's location: "In the caretaker's little room, not two steps away, under the bench on the right something shiny caught his eye. . . . With a bound, he lunged toward the ax (it was an ax) and pulled it out from where it was lying between two logs."

The crime: "He pulled the ax out completely from under his jacket, swung it with both hands, and hardly realizing what he was doing, mechanically, almost effortlessly, he let it fall on her head."

Covering his tracks: "He plunged the sharp edge of the ax straight into the water. . . . He pulled the ax out and washed the blade, then for three long minutes rubbed the blood-stained wooden handle."

The disposal of the weapon: "He had time to put the ax back under the bench, and even to cover it with wood as he had found it."

Raskolnikov's grim resolve has been amply demonstrated, and the ax can now disappear from the book.

Excerpts from *Crime and Punishment* translated from the Russian by Ellen Nidy

Scorer

A great deal of force is needed to work this tool, which is a metal ring equipped with a handle ending in a cutting groove.

Though it looks very different from the one used by the master cooper to etch a mark into a barrel, this forester's or lumberjack's scorer is used for the same thing: to make a mark on wood.

The oak used in barrel bottoms is not the same as the trunk of a tree in the forest—it has a very smooth surface that is easy to cut. And it is no easy matter to debark a small surface of a tree to prepare a "notice" for the mark; the mark has to be clearly visible from a distance, so it must be carved deeply. That explains why the scorer's U-shaped handle is so large. The tool's weight reduces the amount of force needed to dig into the wood, and the wooden handle covers an oval-shaped iron guard that provides good protection for the fingers from the rough bark. This precautionary measure is useful, since anyone familiar with manual labor knows from experience that there is a difference between a single movement and a repeated one. The first ten marks will be engraved deeply and precisely. By the fiftieth time, fatigue or distraction sets in and the worker, now less careful, runs the risk of slipping and being injured.

THE LOST AX: A BALINESE FAIRY TALE

A lumberjack's ax falls into the water. The man bewails his loss so much that a water sprite hears him. "Is this your ax?" she asks, showing him a golden ax.

"No," he responds, "mine is made of gray metal."

The sprite dives into the water and brings up a silver ax. "Is this it?"

"No, mine is old and nicked."

She dives in again and reappears with the lost ax.

"That's it! O, water sprite, how can I thank you?" the lumberjack cries.

"By keeping the other two and by always remaining as honest!" she answers, disappearing into the waves.

Saw-Set

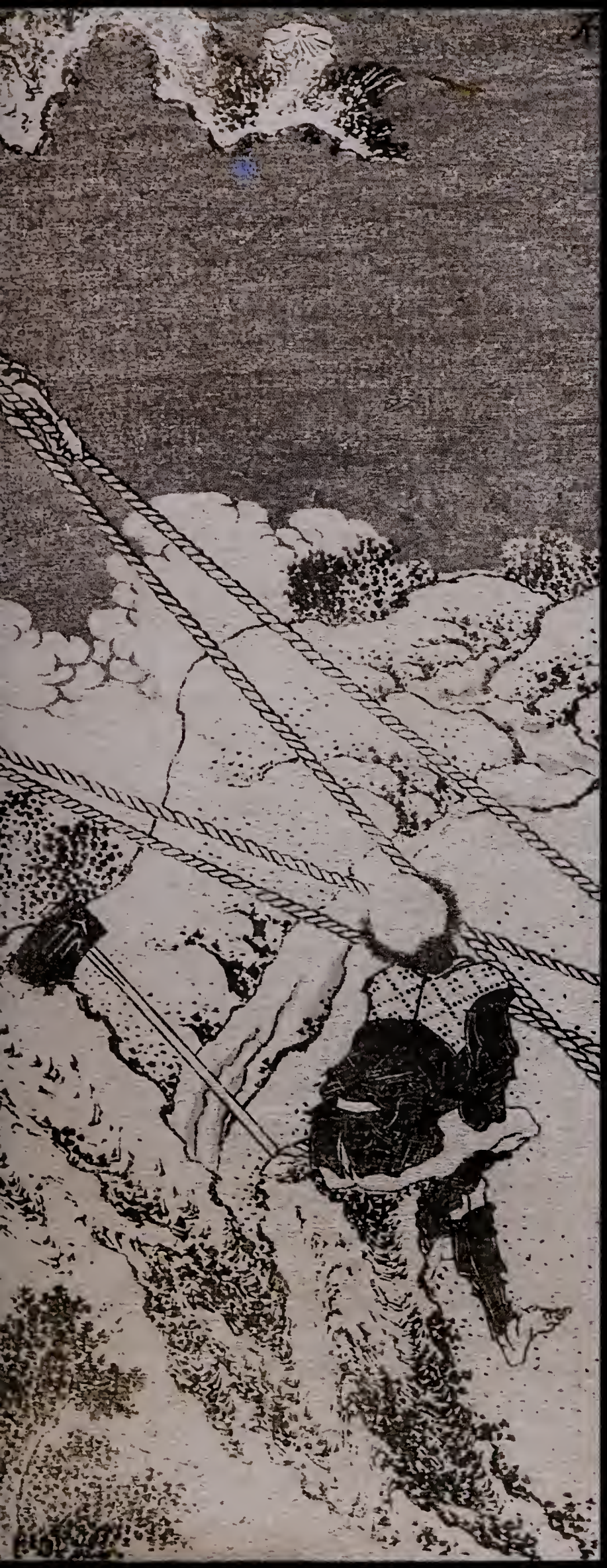
Pit sawyers at work in Nepal.

This is a very specific type of tool—it works on another tool. In fact, it is inseparable from the saw. It is used to bend the teeth of a wood saw, one at a time, to the right and to the left.

Why? Because the groove cut into the wood by the blade must be wider than the thickness of the saw, so that the saw's back-and-forth motion will not be slowed. This additional space also makes it easier to remove sawdust, which, without this path, would eventually block the groove being cut.

The saw-set enables artisans to set the teeth of their saws on site whenever the need arises.

The different slots in the saw-set make it possible to work with the teeth of saws of various sizes.



HOKUSAI

Lumberjacks in a Tree
From "One Hundred Views of Mount Fuji," 1835

At the age of seventy, the great Japanese artist Katsushika Hokusai, who called himself "the drawing-crazy old man," set about to celebrate Mount Fuji, the volcano with the classical outline that had become a kind of tutelary power for the country's inhabitants. As was Hokusai's custom, he went after the most original and most varied. He populated the mountain with the most unexpected professional groups; he transformed them into a static phenomenon surrounded by a world in turmoil.

In this two-page woodcut, Hokusai portrays three acrobatic lumberjacks tackling the limbs of an ancient tree. On the left, one of them is already at work, with his face turned up. He seems to be completely suspended in the air among the birds, even dominating the mountain's majestic outline. The loop of a heavy rope wrapped around his waist secures him to the tree. A second figure has climbed far up the tree with his long-handled ax on his belt, like a deckhand in the rigging or a monkey in some vines. The third is seated on a stump he just cut, relaxing for a moment with his formidable tool thoughtfully stuck in the trunk.

Above them the landscape is peaceful, even though the tree seems to struggle, as if it feels the mutilation, to painfully tense up like a wounded animal in excruciating pain. Nonetheless, the workers' extravagant poses—no doubt observed by Hokusai in real life—are the artist's bemused wink at his audience.

The Pit Saw

This is an extremely cumbersome tool with a very large blade, and it is best to see it in action to understand how it is used. The frame is about five feet high and about three feet wide and has a handle at each end. In the center of the frame, the blade is held by a tightening screw.

The log brought to it by the lumberjack or an assistant has a predetermined fate—it will be cut into a beam or boards. The worker using the pit saw will mark a square or parallel lines on the log with a snap line (the same as the one a mason uses).

The wood beam can be placed on a sawhorse, a sturdy sawbuck that looks like a quadruped consisting of a strong beam mounted obliquely, supported in front by two struts set wide apart.

The log is chained to the sawhorse and firmly secured using wooden wedges. Then half of the trunk is suspended in the air. One of the workers, on top of the log, proceeds backward, sawing, while the other, standing on the ground facing him, moves forward. The tool is massive and the job hard—not to mention unpleasant, due to the clouds of sawdust the work throws off. Once they have gotten through half the log, the two workers turn it around and cut from the other end, carefully following a precise path. The cuts join, and the boards are stacked up and sorted into small piles to allow the air that will dry them to circulate—when they are stacked, the boards briefly re-create a version of the old trunk in latticework.

Opposite: **Sawing trunks in the place they were cut down. France, 1908**

When a man wants to make a canoe, he goes into the woods to look for a large cedar-tree. He carries his chisel. As soon as he finds a large tree, he cuts a small hole in it. He tries to reach the heart of the wood in order to see if it is sound. That is what the canoe-builder calls "feeling into it." If the heart of the tree is not rotten, he goes home at once, and on the following day he goes out, carrying his ax in order to fell the tree.

When he arrives, he looks for the branch side of the tree, and cuts it, that the tree may fall on the branches. The canoe-maker takes his chips and throws them at the place where he wants the cedar-tree to fall. As soon as he hears the wood cracking, he prays, "Do not fall too heavily, else you, great magician, will be broken." Then the cedar falls.

American anthropologist Franz Boas,
The Kwakiutl of Vancouver Island

The By-products of Tools

The blade of the felling ax strikes. Splinters fly around the trunk. They scatter. They disappear; they turn into humus and return to the earth. They are lost forever to the mass of the felled tree. It is as if they had been stolen, as if they were the price paid for human enjoyment—the cost of resistance, the cost of the compactness of matter. A toll. They are the fee a tool traveling through wood has to pay when it transforms a standing tree into a wooden board. No cutting tool has the almost ideal blade action of a butterknife, a diamond on glass, or a knife through meat.

The powdered wood—sawdust—at the base of the stumps of large trees that indicates that they have recently been cut down stays on the ground where it is. It is not worth gathering; there is not all that much of it, and it is too mixed with twigs, moss, and leaves to be of much use. Equal to the volume of wood of the groove cut to separate the two parts of the trunk, it is a negligible amount, a lost entity.

However, when a trunk is cut into boards at a mill, a large amount of sawdust is generated and has to be disposed of. It is sold, and then sold again to shopkeepers, who spread it on their floors. Many years ago it was burned in special furnaces.

In the cabinetmaker's workshop, the thin wood strips, the corkscrew-like shavings that emerge in front of the plane blade pile up on the floor. From time to time, the artisan sweeps them up and pours them into a very lightweight bag. Bakers use them. All it takes is a match held to these shavings to make a bright flame leap up to the bundles of wood in an oven.

The remnants left by a sculptor—the largest stone chips, at least—enjoy a different fate. The overwhelming majority of them are scattered, dumped, or used as fill. But long ago some of these fragments were privileged to be used as sketchbook pages by the master builders of ancient Egypt. An animal, a flower, the profile of a pharaoh, or the silhouette of a worker would be drawn on these stone pieces with a quill dipped in black ink. These depictions were distributed to sculptors at the worksites. The artisan's job was to faithfully enlarge the sketch.

Artists' or artisans' workshops always contain stubborn coats of marble, stone, and plaster dust. Rounded contours, softened edges, obliterated corners, the dust of time, the snow of labor worked its magic, needing only a breath to blow it away.

A blacksmith's forge is just as filled with dust—iron dust and rust powder, iron filings smelling of dust used to convince children of the magical power of magnets, thin shavings of bluish iron shaved by the locksmith's tool, too sharp to be handled, too light to be reused. They meet their end in a kind of final rusting place.

In the glassblower's shop, the bubbles, the splinters, and the shards are swept up at night and added to the sand for the next day's glass casting, as starter.

Nothing goes to waste in the potter's shop. Once a pot is finished, we see the familiar gesture of throwing the bits of clay still stuck to the potter's wheel or small tools into a clay bin.

Finally, we must give credit where credit is due. At the end of the day, in goldsmiths' shops, the sweepings are collected, and the soles of everyone's shoes are brushed. The bits are combined, and the heat of the crucible produces a small gold pearl.

Working often means removing material—and creating wood shavings, wood chips, iron filings, and so on.

Hatchet and Adze

Although the two tools consist of comparable elements—a wooden handle and a stone or metal blade that widens toward the edge—they are fundamentally different. In the way in which they are used—their function—you could say that they cannot be reduced to each other and cannot be replaced one by the other.

The blade of the hatchet is parallel to the handle along its axis. An adze's blade is positioned perpendicularly to the vertical of the handle, and turned toward it.

The hatchet cuts small branches or cuts notches into the trunk of a tree about to be felled. It can be used to chop down a bush.

A cousin of the farmer's hoe, the adze can be used to hollow out a dugout canoe or to smooth the shape of a tree to create a door plank or a square beam.

The hatchet is held at the end of its handle and the blade is swung away from the body. Workers draw the adze's edge in, toward themselves.

There are adzes in Africa and Oceania whose handles are roughly the same as those on hatchets, due to the way they are used. On the other hand, in Europe, the handle of an average adze is reduced to a grip not much longer than the width of a hand.

Finally—and this is how to tell them apart immediately, especially when there

A minimum of means.

Dexterity does the rest.

New Guinea.

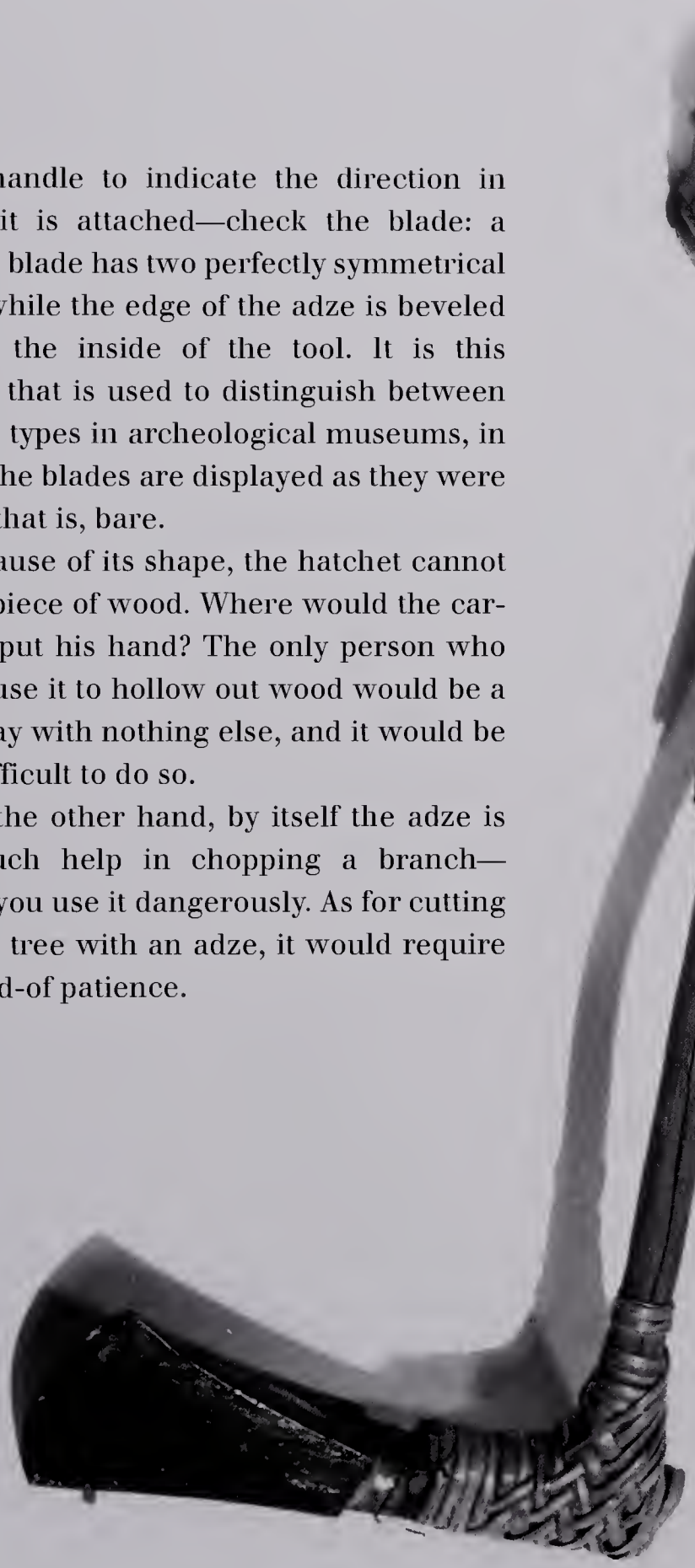
is no handle to indicate the direction in which it is attached—check the blade: a hatchet blade has two perfectly symmetrical sides, while the edge of the adze is beveled toward the inside of the tool. It is this feature that is used to distinguish between the two types in archeological museums, in which the blades are displayed as they were found, that is, bare.

Because of its shape, the hatchet cannot trim a piece of wood. Where would the carpenter put his hand? The only person who would use it to hollow out wood would be a castaway with nothing else, and it would be very difficult to do so.

On the other hand, by itself the adze is not much help in chopping a branch—unless you use it dangerously. As for cutting down a tree with an adze, it would require unheard-of patience.

If we can think of the hatchet as a heavy throw knife with a handle, the adze is like a swung plane that removes chips from the wood and the edges from the spots to produce a smooth surface. As a cutting tool, it was replaced by the mallet and chisel, which are more precise.

In Europe and America, the adze is used as a transitional tool. Rather than constructing vessels by gouging out a trunk, we put them together on frames with pieces of wood. A tabletop and a cupboard drawer often receive their final finish by a worker using an adze.



The coupling of this Indonesian hatchet is strengthened by woven wicker.

In a more rudimentary design, the blade of this adze from Mali is embedded in the club-shaped handle.

This small copper object is a faithful reproduction of an African tool.

Miniature Adze

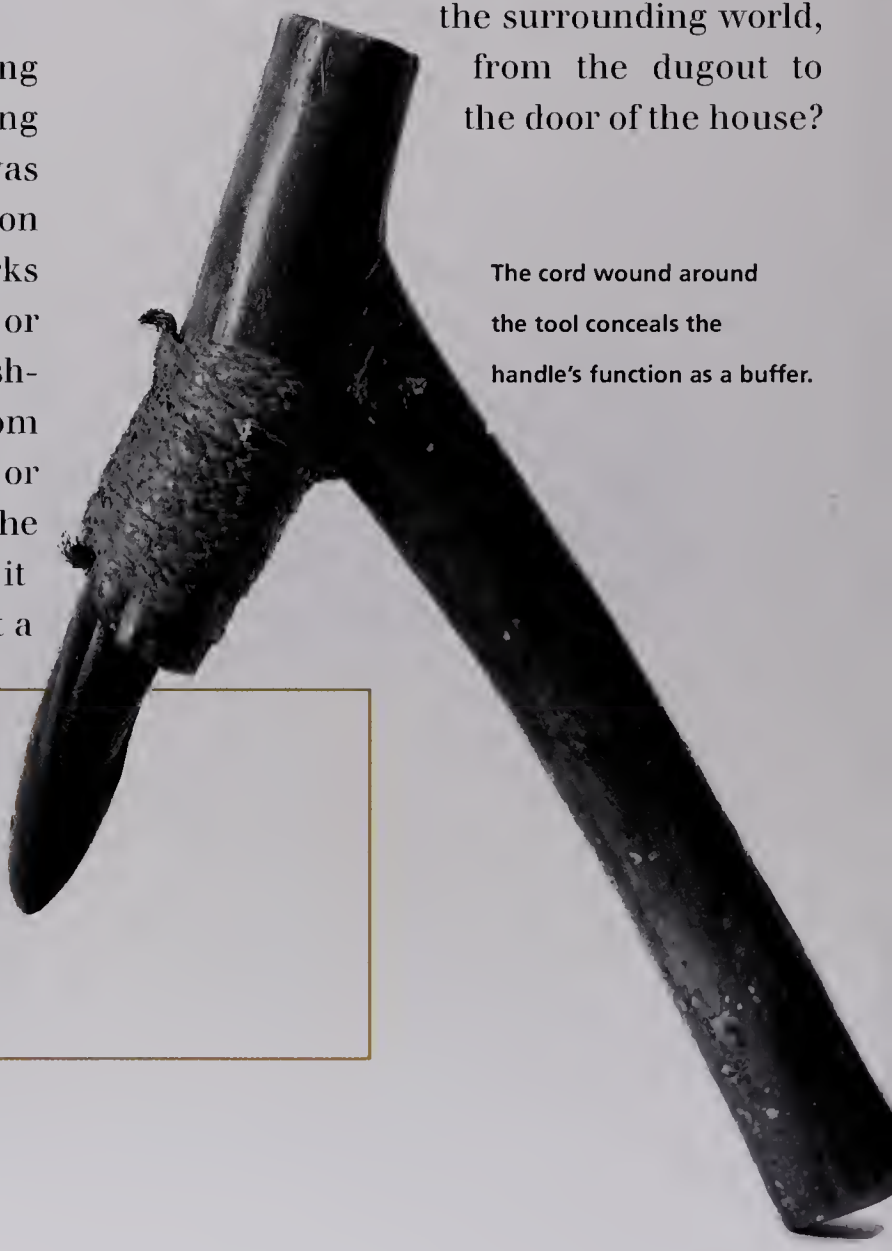
ASHANTI GOLD SCALES

In other parts of the world, people look for gold in river sand. In the heart of Ghana, the Ashanti people—who have been producing gold for a very long time—dig mine shafts in aggradational deposits.

The glistening powder, the yellow grains, are gathered, collected, and melted into ingots. Because gold was not used as money, but was reserved for the powerful few, the miners sold the metal to artisans or their go-betweens.

These transactions took place using an often rudimentary scale, but the reading was always fair. A small heap of gold was placed on one tray, and a copper weight on the other. These weights were small works of art, far from the perfect cylinders or hexagons we use today. They were fashioned in an infinite variety of shapes, from geometric figures to insects, animals, or everyday objects. They were made using the ancient lost-wax technique. This is how it is done: you mold an object in wax, insert a twig into its top and bottom, and wrap everything in a ball of clay, which you then fire. The wood burns away, and the wax melts and flows out. You pour molten copper into the hole on top using a small iron ladle. Then all you have to do is to let it cool down, break the clay casing, trim off the metal stems that have replaced the twigs, and you have a copper replica of the wax object you created. The African carpenter's adze on the upper left is such a faithful reproduction, with its angled handle, solid socket, and broad blade.

I asked a Ghanaian why the weights are made in such great variety—from a star to a crab's claw to a turtle, a catfish, and a grasshopper—and he answered that weighing gold is a very delicate act, such a tense moment that the weigher had to find a subject of conversation that would briefly ease the mood. What could be better than a symbolic design, such as a familiar animal or this tool, a descendant of which one could easily say had helped shape the surrounding world, from the dugout to the door of the house?



The cord wound around the tool conceals the handle's function as a buffer.

POLYNESIAN ADZE, SOCIETY ISLANDS

The Polynesians did not use metal, so stone tools, especially bound adzes, were used in all types of building (constructing houses, making dugouts, and fashioning objects such as statues of ancestors for everyday use or religious worship).

ADZE FROM MOUNT HAGEN, CENTRAL PAPUA NEW GUINEA HIGHLANDS

This imitation adze, a mark of social rank, plays that role because tradition recognizes and assigns it that value. There are also two other reasons. With its wooden blade, this adze is unusable; its creation is a luxury, by and of itself proof of power and nobility. Finally, its design, the polish of its long broad wooden blade, and the attention paid to the wickerwork joint lend it a beauty we admire, much as the villagers in New Guinea must have.

Attached to a base, this Polynesian ceremonial adze (Cook Islands) celebrates the magical power of tools.

Adze

Like an ordinary adze, this stone ritual adze (right) is built on the buffer; the heel of the blade is connected to a stop cut into the perpendicular part of the tool. The stone blade is then skillfully held in place by a long interlaced cord, which produces a very beautiful decorative geometric pattern.

The handle, completely covered with painstakingly incised motifs, becomes a sort of base or pedestal.

It is interesting to note that adzes, which had an unknown function (offering, veneration, attribution of temporal or religious power, and so on), were quickly copied to be sold to European explorers.

The Enigmatic Sign of the Adze

Many texts by ancient Latin authors contain the formula *sub ascia*, meaning "under the adze," to indicate that someone has died. The burial steles also contain the words *sub ascia dedicavit*, after the name, age, and perhaps a summary of the life of or offices held by the deceased; presumably, this attests that funeral rites were scrupulously performed.

The tool coopers called an "ascia" was a special, early form of the adze. It has become obsolete; as a cutting tool it was replaced by the chisel and mallet, and in planing, by the bench plane.

Latin writers, including those whose view of their times was historical, sociological, or encyclopedic, seemed to have taken the key to the mystery of the adze—why was it associated with death?—to the grave. The ancient Romans were famous for being devoted to rituals and to their superstitious beliefs. What the "ascia" represented, when its presence at a funeral ceremony became necessary or beneficial, may have been a truth so commonplace, everyday, and well known that there was no need to discuss it—or perhaps they believed the very mention of it could bring bad luck.

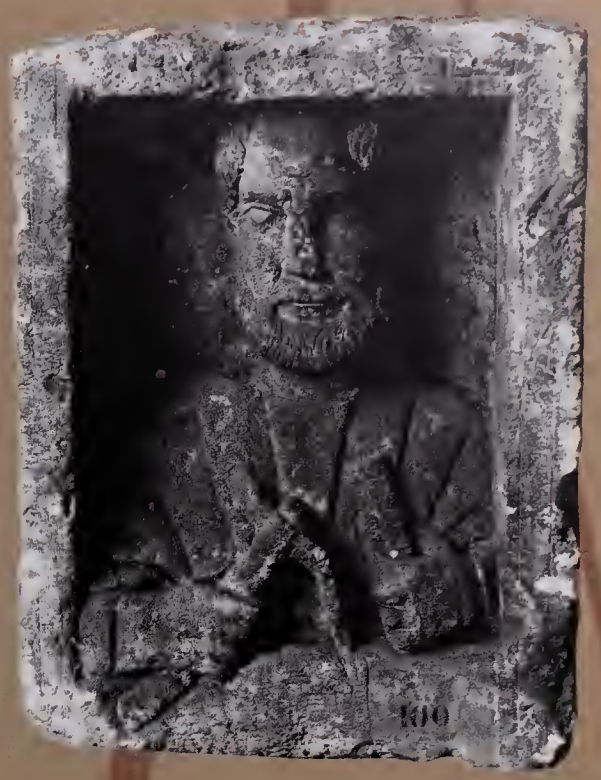
Then, all these explanations were advanced, endlessly, by a seventeenth-century Italian thesis (partially in Latin) that catalogued them without, unfortunately, settling them. According to the thesis, the tool in question was used to cut down the lumber for a funeral pyre, to mix the plaster for the tomb, and to cut the

The Gallo-Roman stele in the Musée d'Aquitaine in Bordeaux, France, clearly shows the "ascia," a tool with a horizontal blade.

stone for the sarcophagus. All of these functions take little notice of the real use of the adze.

The discovery of an "ascia" pattern engraved on the outside wall of Gallo-Roman sarcophagi from Cisalpine Gaul, kept in France in the museums of Avignon, Aliscamps, Arles, Chalon-sur-Saône, Bordeaux, and as far as Mayence, has not contributed to solving the mystery.

These may be the graves of cabinetmakers or carpenters. A miniature adze (or the representation of one on a grave painting, which amounts to the same thing, as the representation equals the value of the real object) accompanied the Egyptian dead. The tool and instrument was used to open their eyes and mouths. Why did it survive? Was it remaining faithful to an ancestral belief whose meaning had been lost? Can the answer lie in an as-yet-uncatalogued manuscript?



Here, we see a carpenter at work, tool in hand. Musée d'Aquitaine.

There may be a lesson in this lack of certainty. It is moving to see engraved on the stone tablet of the eternal abode of the dead the profile of the tool whose successors made it possible for human artisans to build their societies and make objects for daily life.

Recent excavations of the necropolis of Nave, near Brescia, Italy, confirm the custom of sacrificing a piglet at the burial ceremony. The use of an adze to carry out this rite leaves the question unresolved. Why did the Romans use this tool when they already had the knife, the cleaver, and the ax? Did the "ascia" have to be purified by and in blood?

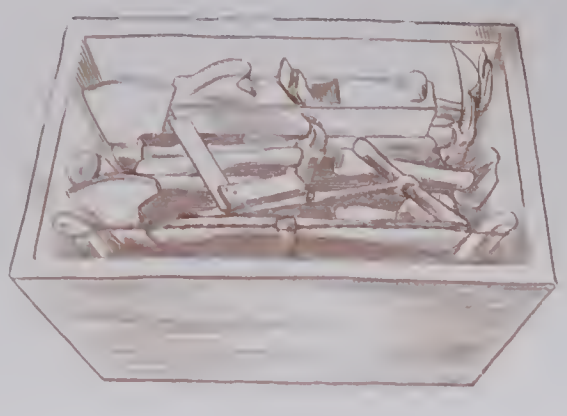
Robinson Crusoe's Tools

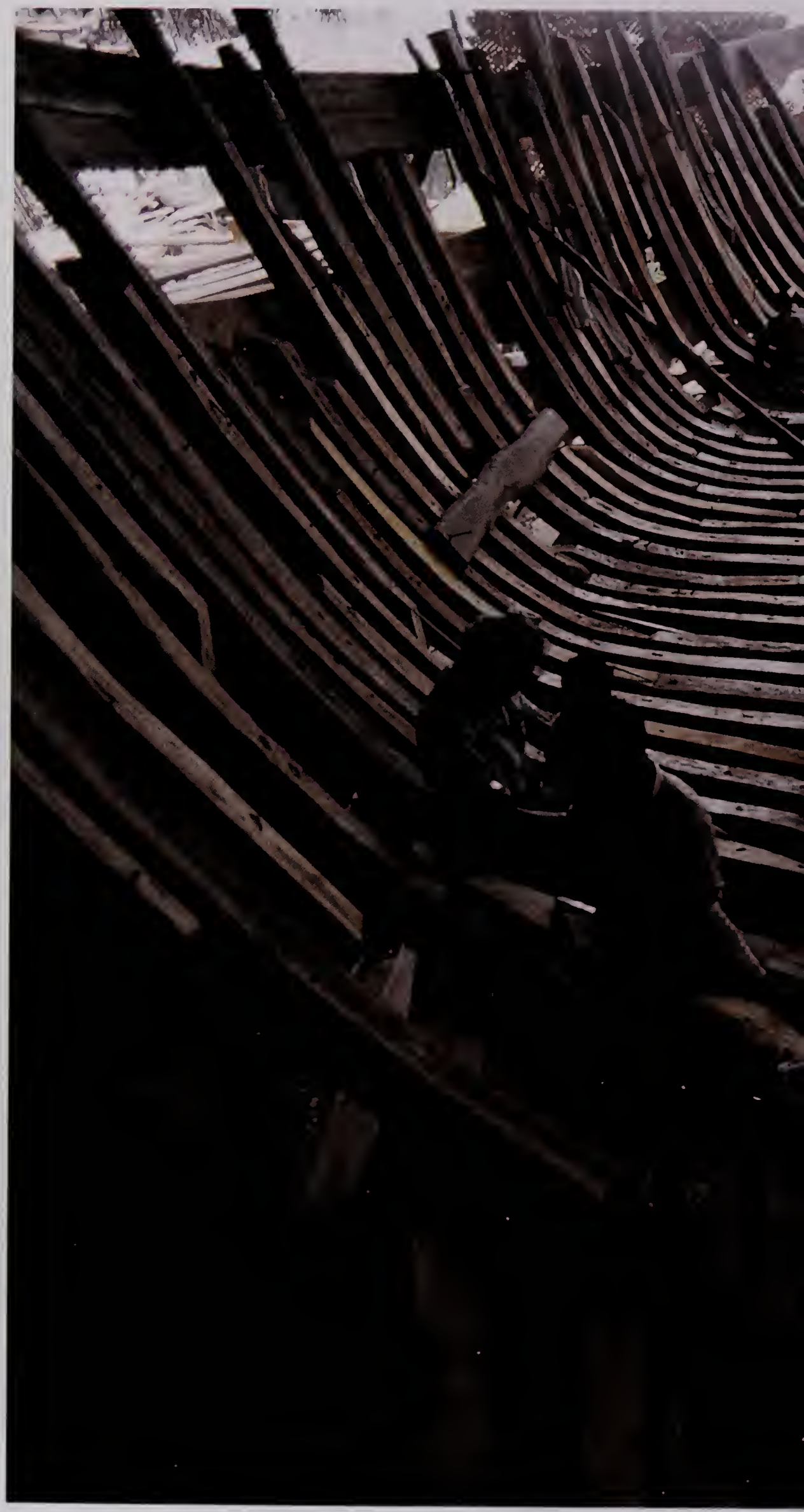
As a child, I read the tragic opening of the adventures of poor Robinson Crusoe with a passion—my heart pounded, and I was filled with hope. What misfortune, bad luck, abandonment, and courage! Would he make it? If only I could have helped him!

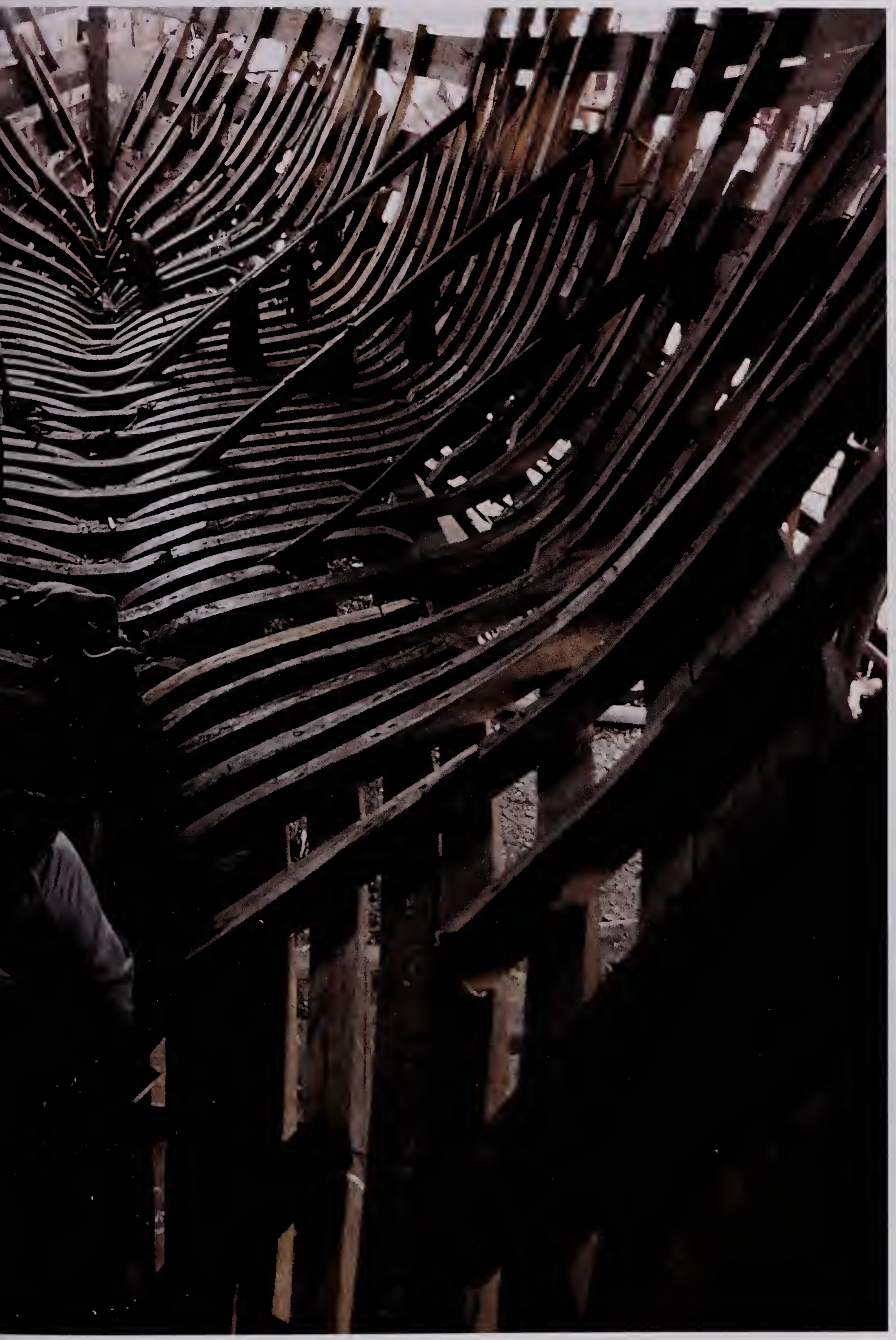
And later I read: "For I had other things which my eye was more upon, as first tools to work with on shore, and it was after long searching that I found out the carpenter's chest, which was indeed a very useful prize to me and much more valuable than a ship loading of gold would have been at the time."

Of course. To be sure. But that makes things too easy. A chest filled with tools! A mirage! What peculiar solitude! It was all there; nothing could stop him. And a naval carpenter, too! Later in life I found out what that chest contained. As a child, I had a premonition. I could see, as clear as day, that the two of them, Master Daniel Defoe and Master Robinson were putting something over on me. Too bad, gentlemen, I left you at the beginning of your book. The castaway's incredible made-up adventure you promised me has vanished. You took a shortcut. That's too easy. To a soaked castaway, even a single tool would be a great advantage over his bare hands.

I thought of leaving these scoundrels right there on that page, but then I went on reading after all, to give them a chance and to find out what they would do.







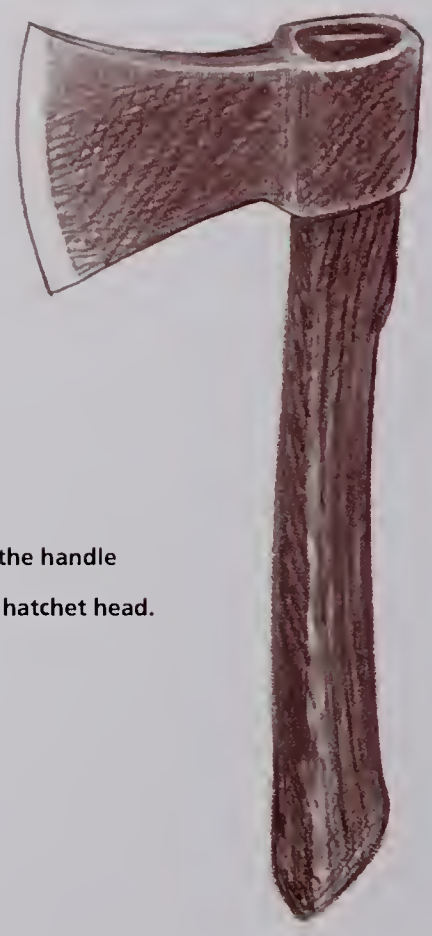
A ship's hull looks like the ceiling of an inverted cathedral. Sailors had to set sail with every tool and provision they might need. Carpenters at work in Calicut, India.

Joining

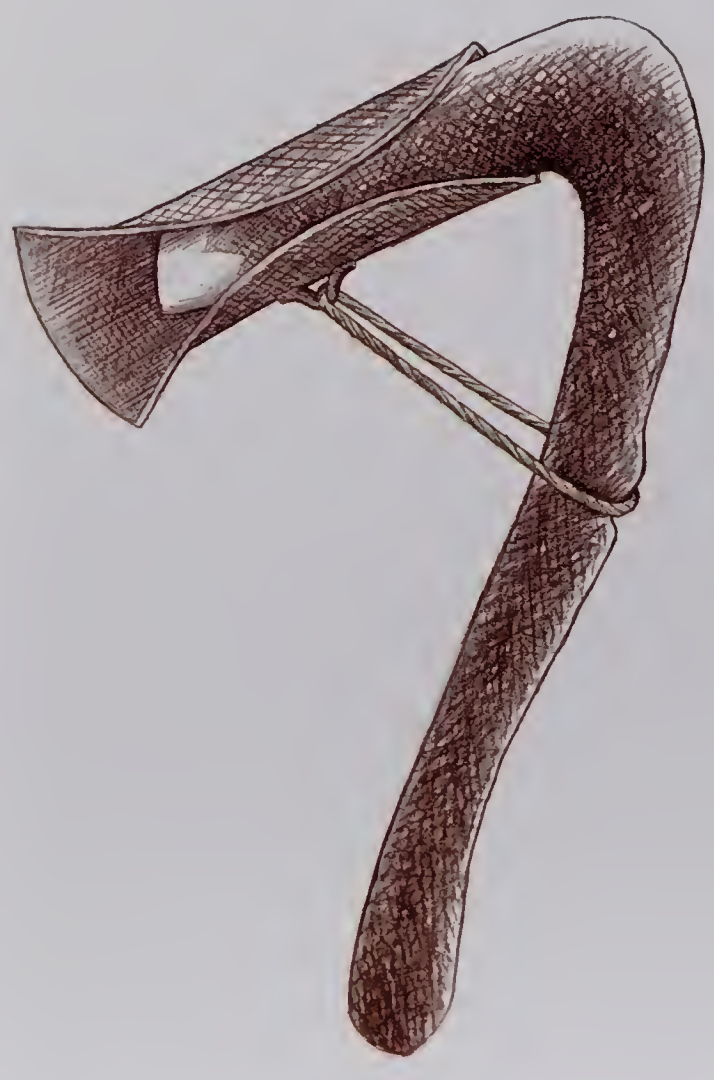
In the history of technological invention, joining represents an ingenious response to the difficult question of linking and combining materials and shapes so that they can be used.

Placed at the end of a lever, the body of a hammerhead strikes with greater force. Swung at the end of that supplemental forearm made of wood, the ax blade carries an impetus additional to its own weight.

We still have to find the material with which to make the handle, to choose it from the materials nature offers to those who have to make a tool. Though the parts will be securely fastened to each other, in most cases the two parts of the tool—the head and its handle—must be made of different materials to save weight and to cushion the blows.



The final model: the handle inserted into the hatchet head.



Metal joins forces with the curved handle.

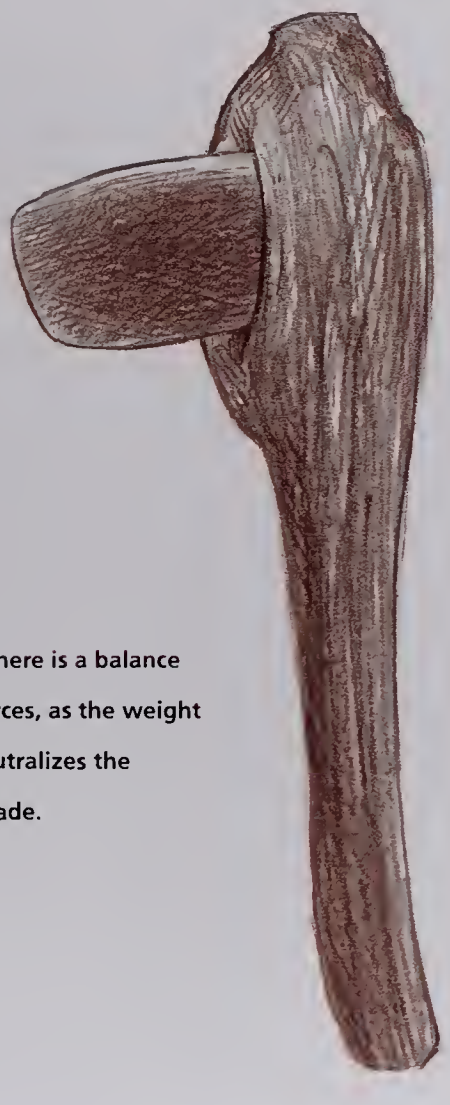
It is obvious that a hammer or hatchet with an iron handle would have a center of gravity toward the top of the handle instead of in the center of the tool's operating mass. This would decrease efficiency, as energy would be wasted in lifting dead weight, not to mention the struggle against an unbalanced tool. A hammer or ax made entirely of stone is inconceivable, even if it had a very short handle, because the artisan would be inviting the tool's destruction. Also, the blows against the material being hit would be transmitted to the arm in full, resulting in serious injury. For example, just as cork absorbs sound in acoustics, the wood of the handle "attenuates" the shock from the hammerhead. As well as being hard and solid, a well-chosen wood is also supple, even if this quality is not readily apparent. Finally, the wood must be available in quantity in a readily usable form. A person can look in the forest for a stick of the desired length and diameter. Some long animal bones might inspire a toolmaker looking for a handle, but bones' tubular structure makes them too fragile to use, especially where the two parts are connected.

As for compact bone masses (elephant skulls, for example), these can be ruled out due to the great amount of energy needed to cut them.

One is tempted to say that as necessity is often the mother of invention, a stout branch was the first step to inventing the handle. To hold a stick in your hand and feel it is enough to instantly get a clear idea of the advantages associated with this simple object: from a simple static point of view, the body is merely extended by the length of the stick, but seen from the perspective of dynamics the additional force from the lever effect is a substantial gain.

We still have to firmly attach the material of the blade—stone or metal—to the wood of the handle. For the ax, the problem is immediate: how to affix this triumphant material, wood, so that it resists the repeated and violent action of striking?

A "finned" blade: the invention of the groove-cutting tool.



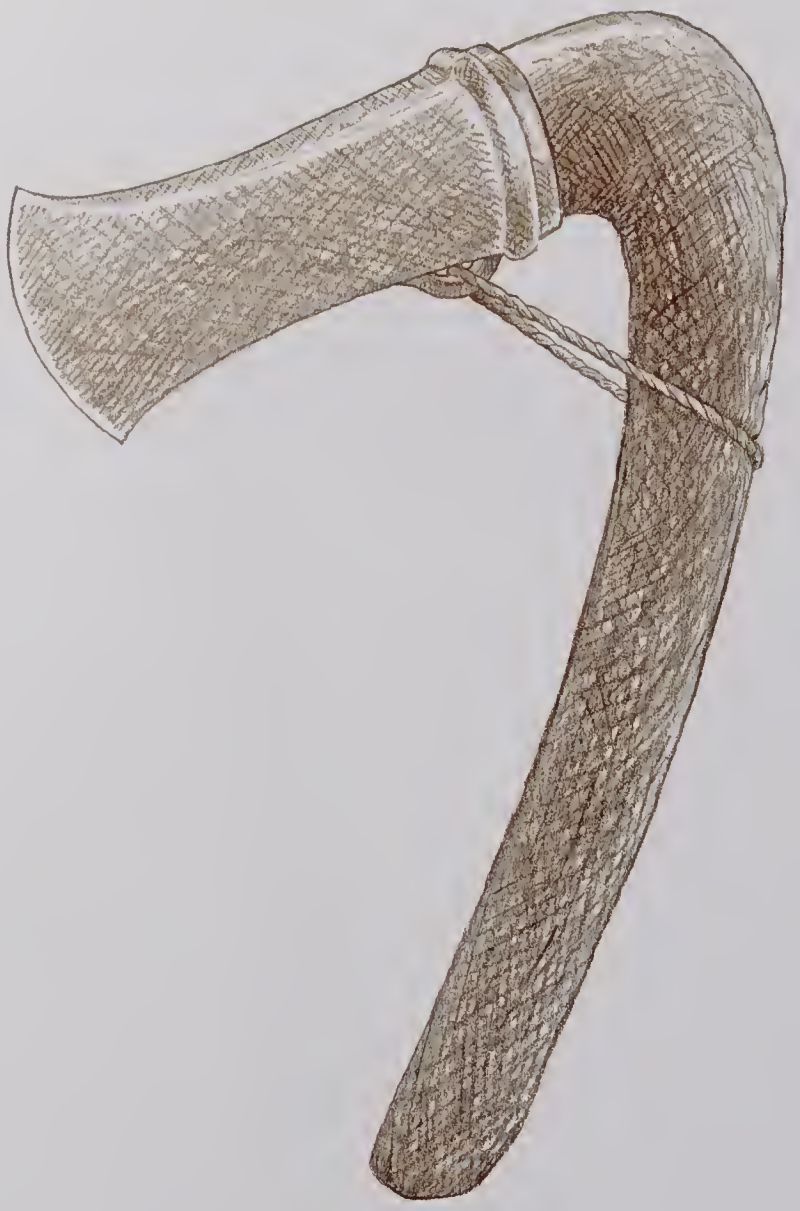
In this first ax, there is a balance between the forces, as the weight of the wood neutralizes the shocks to the blade.

In the course of the development of technology, various solutions have been found, with occasional wrong paths that have led to dead ends.

The simplest system for joining consists of inserting the club-like handle into the heel of the cut stone ax, the bulging part. The solution is promising from the point of view of the solidity of the tool. The wood plays its part as a buffer, and using the tool helps to drive the stone into the handle.

Some European and American stone axes contain a transverse groove cut into the two halves of a natural fork secured at the top by a leather binding.

The tool's overall shape is that of a right angle; at some point people thought to choose a piece of wood naturally bearing this form—or to cut it to give it that shape. The handle's bent head forms a buffer angle, which supports the heel of the blade, which is held in place by a leather strap. If



A socketed ax.

Then bronze was discovered, and the technique of melting it in a crucible was followed by pouring it into a mold. However, technological innovation cannot be forced any more than pure and simple invention. In fact, doubtless because they found it impossible to cast a copy of the best stone ax in bronze, the metalworkers of the Bronze Age attempted other solutions to the eternal question of how to attach the blade to the handle. They preserved the idea of the angled handle by adapting the ax hole into a socket in the foot of the ax, or, by using an ingenious "bill" device, they attached the

the stone blade is placed horizontally, you have a hatchet; if the edge is parallel to the handle and the heel inserted into a crossed slot in the "beak" formed by the handle, you have made an ax.

In an attempt to lessen the problems involved with the conflict between stone and wood, people thought to use horn, an intermediary in the form of a cushioning material. A piece of stag horn was placed in the heel of the ax and the hole was drilled to half its length to insert the ax handle.

The blades fashioned from chipping flintstone flakes were replaced by corresponding shapes made from hard stone. Cracking it with another stone and placing abrasive sand on it and then rubbing the sand with the end of a stick turned between the palms of the hand enables a worker to drill a cylindrical hole in the stone. That is the ancestor of the "eye," where the handle is inserted in our axes and hammers. The principle had been revealed.

A stone ax sheathed in stag horn. This was the invention of the shock absorber between stone and wood.

two parts of the handle, which had been split down the middle. Of course, this form naturally led to creating a socket that fit on the end of the handle. Mounted on a short handle, some current tools (Moroccan wood turners, Ethiopian lumberjacks) can alternately be used as a hatchet or an adze, depending on the position of the socket with respect to the handle.

During the Iron Age, this type of joining coexisted with the system of the eye driven into the body of the blade. The Romans had this type of tool, which had come from the Orient and was known throughout the Mediterranean.

In the Middle Ages, blades with very long sockets were used. These sockets were distinctly separate from the cutting part, making them look like halberds.

Development continued. The socket became oval, but most importantly, the shape of the blade became more rectangular.

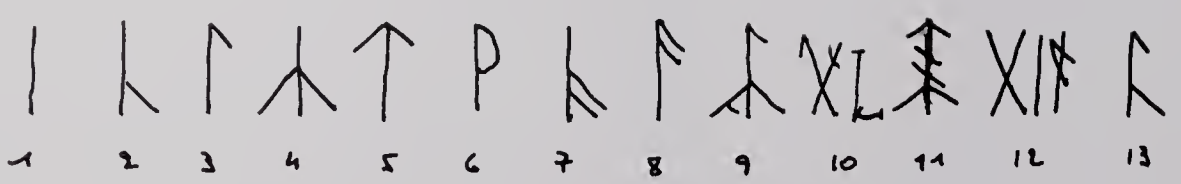
A Laotian balanced ax, or the cult of precision.

One of the first axes was a polished stone tied to a handle.

The principle remained unchanged; balance had been established between the length of the lever, the weight of the tool, and the safety of the coupling. That is, subject to the infinite variations corresponding to jobs, professions, countries, and even provinces. The ax used in one region may be unmistakably different from the one in another.

The T-shaped Laotian ax, whose blade is attached to the end of a long and narrow wooden handle for balance, has fascinated many a Western worker. Its precise cut is indispensable in performing such delicate tasks as finishing woodwork.

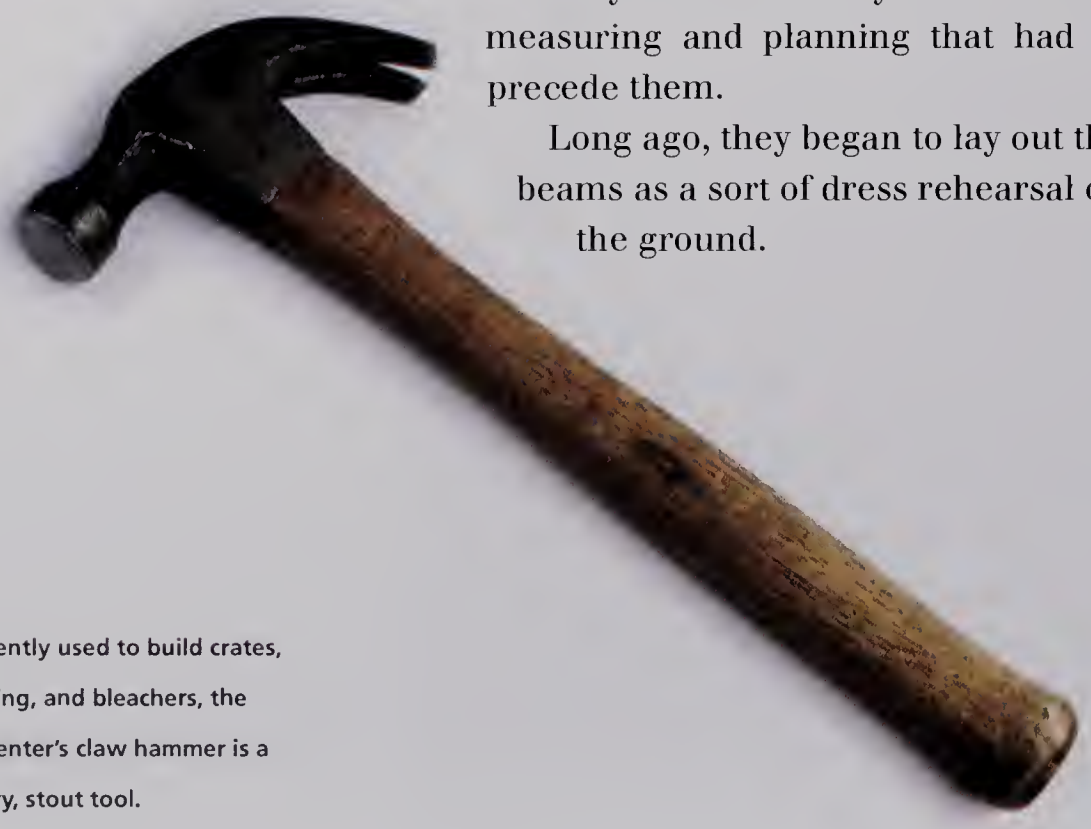
The Carpenter



A building's frame is a skeleton that has to support its heavy outer skin, which can be made of tiles, slate, or sheet metal.

Carpenters are sure to set their profession apart from the lumberjack's. What they mean to say is that the heart—and pride—of their profession is not handling a heavy adze or raising imposing oak beams. That is simply the execution. To be sure, such work requires knowledge and skill, but they are secondary to the exact measuring and planning that had to precede them.

Long ago, they began to lay out the beams as a sort of dress rehearsal on the ground.



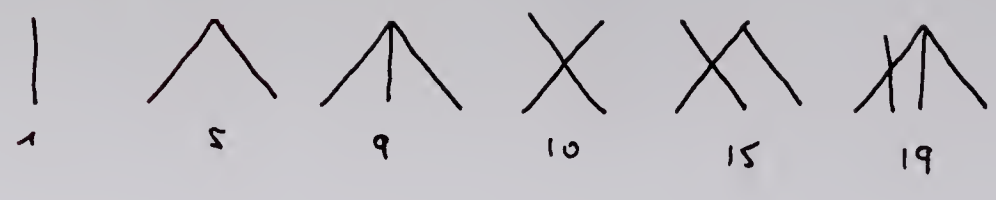
Currently used to build crates, fencing, and bleachers, the carpenter's claw hammer is a heavy, stout tool.

The history of each tool requires us to go back in time, to examine what existed before. If carpenters didn't have the use of a pit sawyer's services, they became lumberjacks. They picked a tree and cut it down themselves, with the help of their assistants, preferably in the winter, when the sap is low. Also, at that time, the lumber is more resistant to insects, those untiring tunnel diggers. Depending on the restrictions of the budget, the carpenter will combine oak, which will last for centuries, with less-expensive poplar. During the Romanesque period, the monks of the French Cluny monastery chose costly chestnut trees to build their impressive *farinier* in the shape of an inverted ship's hull. They knew that insects do not like this wood, so their work would not be in danger of suffering the ravages of time. An additional advantage was that it would never be desecrated by the patient structures of spiders, who do not inhabit such barren hunting grounds.

At times—you may notice this if you look at an attic of an old house, especially in the country—the trunk would only have been debarked. Other times, it was squared off, that is, the beam was cut smooth along its entire length.

Then, the carpenter uses his axes; he is dressed in his traditional *largeot*, coarsely woven or corduroy pants with wide legs and tight ankles that allow freedom of movement but resist getting caught on a sharp piece of wood. The carpenter shares the carpenter's adze (which has a straight edge), used for the roughest work, with his cousin the cooper; both artisans use the lighter cutting ax with a longer handle, triangular head, and a slightly curved edge, as well.

Even when used with the knowledge and skill acquired by experience, these heavy



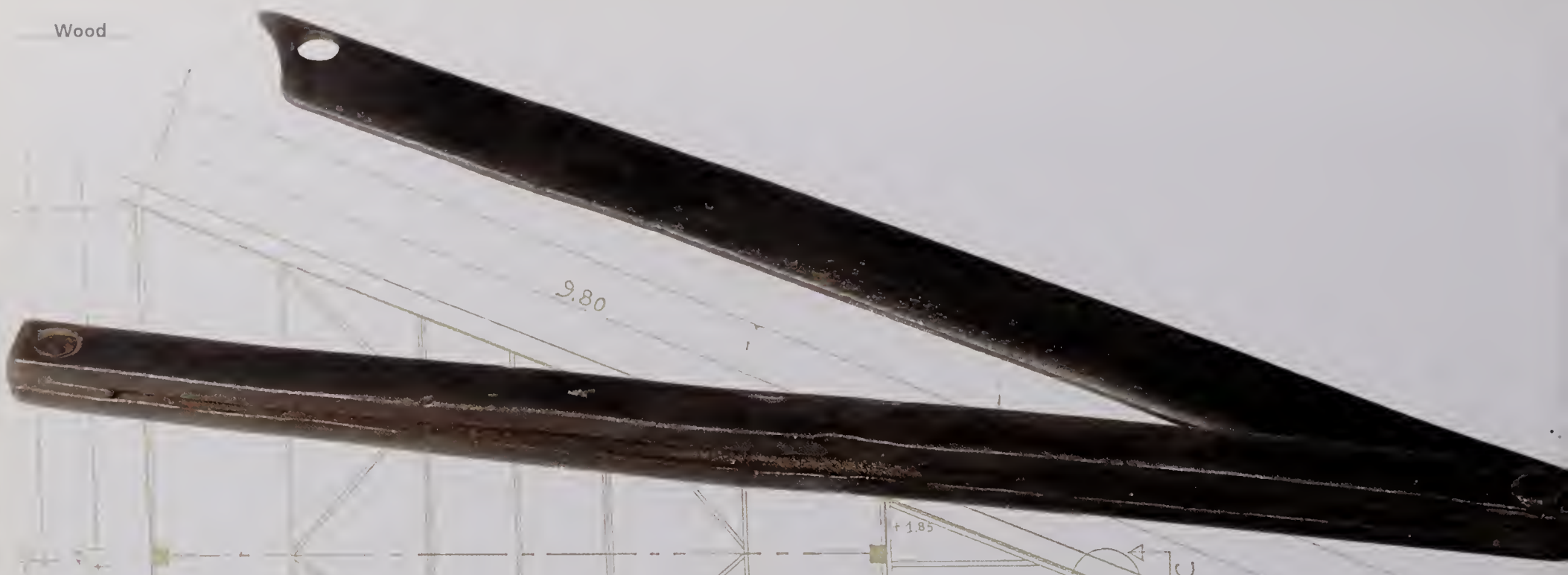
Master carpenters and their assistants build the frame on the ground.

tools could pull out big splinters, leaving a series of points rather than a smooth surface.

The carpenter takes up a different adze to eliminate these slight protrusions This adze is quite a heavy tool, with a handle at an acute angle to the broad blade. Positioned below the beam, the artisan uses the tool by swinging it in, toward the body. It doesn't dig; it grazes the surface of the wood, largely due to its weight, and draws up only tiny shavings.

Building frames is not the same as cabinetmaking, though the carpenter finishes squaring the beam by planing its surfaces. The bench plane's blade is wide and the lumber puts up considerable resistance, so you work the plane with both hands: one pulls and guides the tool by holding a wood horn affixed to the back of the block, and the other pushes one of the two strong wood shafts forward. Why are the tools used in this order, the plane last? Simple. Planing means moving along prepared ground. The number of possibilities is thus limited, greatly reduced. If the tool runs into large protrusions, it is either stopped or risks pulling up chips of wood when it should be making long, thin, curled shavings.

When required, carpenters set aside their familiar tools and take up a notebook. Actually, they are never without a big notebook held together by a rubber band—like a horse trader's purse. It contains, in haphazard order, calculations, sketches of previous frames, designs for particularly elegant structures, and prices.



The bevel square allows the artisan to reproduce an angle, such as when they move from one side of the frame to the other.

If possible, a temporary floor is placed in front of the building being constructed. There, the team will chalk out the outline of the pieces of lumber to be fitted, corresponding exactly to the sketch in the notebook, though to actual scale. This piece of lumber would be best for that part, this other one for another, and so on.

The plumb bob gives the vertical, the wood set square enables right angles to be made, the bevel square makes it possible to copy angles, and the large iron compass takes measurements.

With the crosscut saw—so called because it is used to cut against the grain—the carpenter cuts pieces of lumber to the right length and at the correct angle, taking care to leave room for the tenons.

A tenon is a protrusion in a piece of wood inserted into a mortise to make a joint; the hole in the mortise corresponds exactly to the tenon's shape.

A saw is used to cut the tenons, while a mortise is cut out using a large long mortise chisel whose iron-hooped handle takes the hammer blows. For smaller holes, the artisan uses a framing or heading chisel, a rectangular chisel with a slanted blade.

The auger, a large gimlet, is used to drill a hole for the insertion of a dowel. It goes without saying that both sides of the mortise are drilled simultaneously, with the tenon being fitted precisely.

The auger, with its two grips perpendicular to the iron shaft tipped with a sharp "spoon," enables the user to dig a wide hole for the dowel. This locks the joint.

The frame is finished. The master carpenter takes a small tool out of his breast pocket. It is the scorer, his seal. One side of this small iron blade bears a circle with etched notches, the saw-set used to set the teeth of a saw, while the other has a curved blade used to cut grooves in the beams. It was used earlier to mark sawlines on the pieces of lumber. Now, its job is to assign each piece of wood to its final place in the frame. The carpenter puts the same mark

The heavy bisaiguë is used to custom-cut the parts of a frame once they are assembled.

on both of the two pieces about to be joined to avoid any possible error. Such care is taken because, unlike the parts of the Eiffel Tower, which are all perfectly identical (the design was a tour de force of this type of construction), the parts of a building's frame are less interchangeable, more "individual." The advantage of these markings is that they endure. If at some later point the frame has to be disassembled, for example, to replace some beams, it will be no problem to reinstall them.

For reasons of convenience as well as tradition, the numbers used are taken from simplified Roman numerals, according to this principle:

The dowels are ready. The time has come to assemble the frame. All the beams are at hand. The carpenters build a lifting gear with a pulley and capstan. The pieces of lumber are put in place.

If, in spite of everything, the tenons and mortises still creak here or there (due to a slight torsion or a new thrust), the carpenter uses a tool whose shape always fascinates those who don't know it. It's called the bisaiguë. The tool is almost four feet long and is made entirely of metal; there is a mortise on one end and a framing chisel on the other, one of which is in the same plane as the handle and the other perpendicular to it. The handle, a hollow iron tube, as long as a grip, is unique among the vast variety of

This large plane, called a try plane, is used to smooth the surface of a beam or remove material.

SAINT JOSEPH THE CARPENTER

Georges de La Tour. Musée des Beaux-Arts, Besançon, France

In the workshop, the carpenter's son, as he is called in the Gospel, holds the candle that lights his father's work. The child is protecting the flame, whose glow marks off a large oval of light. The child's diaphanous face contrasts with the artisan's wrinkled brow, and his slender legs and delicate hands are set off from the man's massive arms and heavy hands contorted by work.

The carpenter is digging a hole in a block of wood using an auger. At his feet, a mallet and a wood chisel are waiting to be used, no doubt to make a mortise. A light, shiny shaving of wood lies close to the child's sandal, evidence of earlier work with the plane.

Very frequently, sculptors and painters of religious art insert into their creations a fleeting allusion to their subject's fate or a connection between the Old and the New Testament. The clergymen who commented on the life of Saint Joseph in writings and images, and the public who listened to them, were equally enthusiastic about these links and allusions.

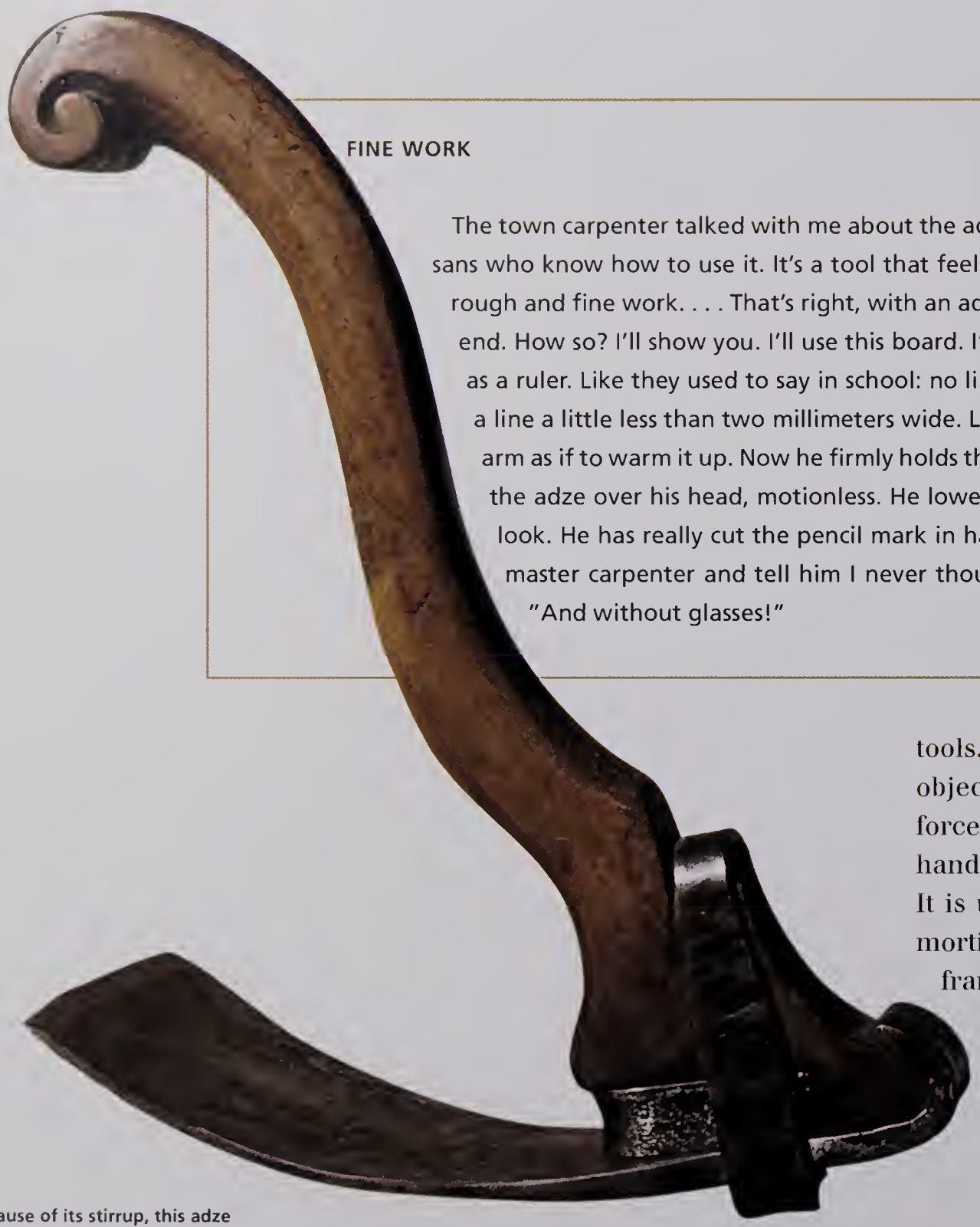
Here—certainly not by accident—the two pieces of wood placed on the ground clearly form the outline of a cross.

FINE WORK

The town carpenter talked with me about the adze: "These days there aren't as many artisans who know how to use it. It's a tool that feels good in your hand and is good for both rough and fine work. . . . That's right, with an adze you can cut a pencil line in half, end to end. How so? I'll show you. I'll use this board. I've got the pencil; I'll use this other board as a ruler. Like they used to say in school: no line without a ruler. . . . There, I'm drawing a line a little less than two millimeters wide. Look." He shakes the tool at the end of his arm as if to warm it up. Now he firmly holds the board down with his left hand. He takes the adze over his head, motionless. He lowers it, violently. A dry bang on the board. I look. He has really cut the pencil mark in half lengthwise! I warmly congratulate the master carpenter and tell him I never thought it was possible. He laughs and adds: "And without glasses!"

tools. The reason for its form is that the object is heavy, powerful, and handled with force—if it had a detachable handle and that handle came off, the lethal blade would fly. It is used to recut tenons and, particularly, mortises on already assembled pieces of a frame, or those pieces that can't be easily worked with a chisel and mallet.

The bisaiguë is definitely one of those tools that are impressive to watch in action and to work with. It



Because of its stirrup, this adze is collapsible, making it easier to transport.

is also one that can't be used by everyone.

Now the carpenter drives in the dowels, which have a slightly conical shape, with gentle blows from the hammer. The thinnest end has to jut slightly out of the beam so that it can be struck, so the dowel can be pulled out if necessary. On the other hand, for the sake of elegance sometimes the carpenter wants to have it jut out less and therefore saws off part of the pin with a small saw with a short trowel-like grip that enables it to be held at all angles.

Now the carpenters can come down from their perch to have a good look. Maybe they'll celebrate the successful completion of the framework by making a toast to their patron, Saint Joseph.

We see other carpenters at work every day in the city and country. They can be recognized more easily by their mandatory hardhat than by their special pants. Times have changed, but we still need carpenters.

What do they make? Large scaffolding for the platform and grandstands used for holiday parades. The traditional dowels have vanished, and joints are enclosed by sheet metal and held in place with tightened nuts and bolts. Underground construction sites in cities use temporary frames when cement is being poured.

Both carpenters—yesterday's and today's—go nowhere without one constant companion on their belt. It's totally out of the question that this special tool would be left behind, forgotten, or need to be searched for. Such a sense of closeness exists between the worker and the tool that if carpenters forget to hook it on, they feel that something is wrong in their step, that part of their body is missing.

That tool is the carpenter's hammer, which is, of course, also used by other professionals. It is the heaviest, squattest, most massive, and most cumbersome of its kind, yet it is also the most beautiful. On one side we have two big animal talons: the claw. On the other, the hammer's striking face, round as the head of a forge hammer. From one end to the other, it is a mass of streamlined metal with elegant lines; with the grace of an anvil it firmly grips the top of the handle, lending weight to the blow and leverage to the claw.

The other indispensable tool for those who use nails (unknown to the traditional carpenter) is the crowbar. For the carpenter, this steel serpent with a flat tail and forked tongue, this invincible curve is used to pull off boards and as a lever. The other end is for pulling nails. Using this tool, and this tool alone, you can quickly dismantle a nailed fence.

The carpenter's adze, a tool used by carpenters and coopers.

VIOLATED TOOLS

Sebastiano del Piombo.
***The Martyrdom of Saint Agatha*, Palazzo Pitti, Florence**

The story is a long one, and it continues to our time. It is the history of the hangman. Church paintings depict scenes of the tortures suffered by martyrs for their faith with the utmost violence, the better to fire the imagination. Hangmen and their henchmen have often been shown as workers of death, oblivious to what is going on, unmoved. But adding the tools they use to torment the martyrs changes everything. The perversion of tools elicits an immediate feeling of disgust and protest. Why this saw, why this ax, why these pincers, peaceful companions of everyday life—why are they also accomplices to crime? Painters of all periods have answered this question. When the carpenter's ax is used to kill, the world is out of joint.

Carpenter's and Woodworker's Saw

JAPAN

Here is an Asian tool—from Japan, to be precise—that fascinates Western artisans. Its small blade means that it can be used to cut lumber less than a certain thickness, such as small boards, bars, dowels in place, the ends of frames, and so on.

This saw can be compared to our handsaw, though there are a number of differences—the shape of the blade, the fact that it is double edged, the configuration of the edges, and, finally, the shape of the handle. The blade widens from the handle up, for the simple reason that the tool is used on the pull stroke; the shape gives the tool the greatest grip and therefore maximum efficiency. Depending on the type of work to be done, the woodworker uses the one side or the other: the larger, more widely spaced teeth can be alternated with those of the other side, which are greater in number and more finely set. It is easier to saw very hard wood with the small teeth, and the larger teeth are better suited to cutting lumber with the grain.

Close observation of the tool reveals another remarkable feature. Its teeth are shaped like claws or hooks and pointed toward the worker's hand. In other words, you pull this tool only; you don't draw it back and forth. The straight handle can also be gripped in different ways depending on the object being sawed. Finally, the flexibility of the blade combined with the shape of the handle makes this tool ideal for flat sawing.

The Japanese are true artists of everyday life. This simple tool is striking in its elegant form.

The elegant design and subtle construction of this Japanese saw indicate its place of origin.

A Japanese artisan working lacquer.

Work Gestures

JAPAN

Like a living being, a tool is born in a certain soil and is descended from a long line. A country of demanding and able artisans, Japan consecrates some artisans, giving them a certain form of immortality.

What more exotic and moving spectacle for a Westerner than to see a master sculptor of No masks dressed in a somber ceremonial kimono seated cross-legged on the ground in front of his workbench with his hundred tools carefully arranged before him? The same is true for carpenters whose job it is to create the same item over and over—such as temples made of old lumber—using traditional tools; for potters who invented bowls of wonderful simplicity; or for those workers who forge saber blades as if time had stood still between the great age of the samurai and our own.

Before drilling a thick board or a piece of wood, a European artisan makes a pencil mark at the center of the opening and digs a pilot hole on that point. Then, in our part of the world, we use a gimlet, a cutting screw at the end of an iron shaft turned using a perpendicular metal or wooden handle.

The Japanese artisan uses an auger for the same purpose. This tool looks like a long shaft of fine wood (the diameter of a very large pencil) with a tempered-steel–tipped iron shaft on its end the size of a large nail with a three-faced tip.

How is a tool like this used? An ancient gesture, if anything. The artisan holds his drill between his palms in exactly the same way as an aboriginal in Australia or elsewhere who wants to start a fire. The underlying reason for this artisan's gesture may go back to a tradition lost in the mists of time—as if humans wished to keep alive the memory of such a miraculous and saving gesture. Japanese workers or artisans use the position they do for reasons of convenience, adaptation to everyday habit. They

Overleaf: **In Japan, forging a sword is a sacred act.**

A Japanese artisan's equipment.

Opposite: **Sculptor of masks for the No theater.**

sit cross-legged, or kneel in front of the low table they use as a workbench. This is an ideal position to push and pull both hands around the rotating handle. A standing worker, perhaps leaning forward, would not enjoy the same stability.

The same pilot hole, two different worlds. Indeed, the artist's gesture using the gimlet is quite different. It does not turn quickly and lightly like the Japanese auger. Like the corkscrew, which drives by turning, it digs its passageway under pressure.

Herodotus said that the ancient Egyptians never did anything like anyone else. When they met, Japanese and Western woodcarvers began by saying, "I don't see how you could hold this tool, much less how you could use it." The Western gouge is a small tool with a cutting blade that varies in form from rounded to the acute angle through a flat surface. The handle is a button; it looks like a small doorknob whose base had been cut cleanly to allow the carver to push the tool to the very surface of the board.

The tool of the artisans who cut the cherrywood for the woodblock printmakers Sharaku or Hokusai is completely different. The same blade is attached at the end of a long handle, a simple cylindrical stick. Engravers hold it between their thumb and index fingers, as they would hold a pencil to draw. They push the tool with their fingers; their Western counterparts use their palm.

In the end, only the result counts. Hercules Seghers, a great and inspired Dutch artist, etched his copperplates with a nail.

A Visit to the Clogmaker

A mutual friend arranged the meeting. Mr. Fauchon will receive me this coming Thursday, just before market day. His name—the French word for a tool, a grain cradle, which is a type of scythe—seems a good omen. The shop is easy to find, on the main street of the village across from the town hall and school.

In shirtsleeves, wearing brown corduroy trousers, a leather apron, and, of course, wooden clogs, the artisan looks up and comes to greet me. He has me enter his domain. It is enveloped in a great softness. The silence of footsteps on the ground vanishes under a carpet of fragrant shavings. The surfaces and angles of the walls, and the windows are softened by a uniform ochre coat that underscores the light curve of a spiderweb: sawdust.

His hands are strong and well matched. His eyes shine behind steel-framed glasses. A block, a workbench, a clamp, a few tools, a large flat pencil. Up along the ceiling, wooden clogs are displayed, so customers can choose the style they want. There are simple all-wood *goudots*, clogs with leather uppers, and women's clogs that are lighter, flatter, and decorated with a floral pattern.

Mr. Fauchon likes people to watch him at work; he loves to explain. "But before I start," he says, "before showing you—I want to make a pair while you watch, it won't take long—I'd like to ask you, when you hear the word *clog* what do you think?"

"Well, a wooden shoe."

"Yes, but how is it made?"

"Carved, dug . . ."

"So, a clog is a kind of sculpture?"

"I think so."

"I'm telling you, for the work we do—I'm not talking about art, of course—a clogmaker beats a sculptor, if I may say so." Mr. Fauchon laughs.

Despite its name, the wooden shoemaker's hatchet is not swung but pushed.

Opposite The trimmer attached to the block by a hook. The tool can be used horizontally or vertically.

"How so?"

"Look at this clog. It doesn't exist just by itself; it's one of two sculptures. The clog is sculpted outside for shape and inside to fit a foot, but also to adapt to it, because each foot is different. Even one person's two feet aren't the same; often the left foot is bigger. I was talking to a blacksmith, and he told me horse's hooves are the same.

"Now I'm going to show you the raw material, and then my tools. There really aren't that many. They're all here around me.

"I have to say that clogmakers were once real woodsmen, and they lived in forest cabins near their raw material. It had to happen: they went right into the reserves, and the forest suffered. An ordinance was imposed, compelling the workshops to be at least two kilometers from the forest. Clogmakers used to use wood from light coniferous trees like pine and other firs. But that wasn't a good idea because that kind of wood absorbs water. Birch is hard to work and takes a long time to wear out. We also use beechwood, elder, and even walnut, which makes high-quality clogs.

"Once a tree is cut down, sawed into logs, and split, blocks about the size of a clog are cut.

"The work begins with a wood shoemaker's hatchet that resembles an ordinary hatchet. In fact, it is quite a heavy tool which is not swung; it is not used for splitting but for planing sideways. The blade is flat on one side, and the handle is placed to one side to allow room for the clogmaker's

Working the inside.

Like the farrier's tool, the clogmaker's gouge cuts in front of him, at the end.

Opposite: **Using his scoop, with a T-shaped handle, the artisan carves the inside of the clog.**

Finishing a clog by pulling the blade toward oneself, like peeling a vegetable.

hand. He holds the wood on the block with his left hand, and with his right, he moves the hatchet back and forth.

"You're going to ask why the round handle end shaped like a huge pear? I support this part on my leather apron, and I push the tool with the front of the hatchet. I've already rough-hewn the top, the front and back, and the bottom: I've carved the heel. I used a hatchet, which, if you look at it, is shaped like a hoe, but it has a sharp blade. Or you can use an ax with a blade attached perpendicularly to the handle. You round it with small strokes.

"Now comes the trimmer, this large saber held to my cutting block by a ring. You use it a little like a baker uses a bread slicer. The one difference is that I can turn my blade back. You see, I turn the clog with my left hand, and I wield the trimmer to follow it so that it takes off long shavings. That's how you shape the sides, like peeling a potato.

"The tool works by its weight. Listen to the wood creak! You have to work it when it's neither too fresh nor too dry. My trimmer has a simple straight handle. In other regions, clogmakers prefer a T-shaped grip that gives them more force to turn the blade. Here, they've always made it like this. My father, when . . .

"Now here you have our first sculpture, like I told you. But we still don't have any room for the foot.

"Look how delicately the rough clog is held tight by the clamp. Put another way, the clamp is a wood vise, because it contains no metal. You cut into the wood using this large auger. You dig a number of holes that roughly set off the limits of the cavity that will become the heel. You enlarge them, and then you join them using this big spoon which you push by turning the two transverse grips perpendicular to its shaft.

"Now we have to work our way toward the front of the foot. By using the gimlet and the auger again—but now not vertically but

at an angle—I can widen the hole. Then, there is this tool, the shaper, with a long, cross-shaped handle—long so that it can reach deep inside. It digs horizontally, making the 'floor' and the 'roof' of the space where a person will put his or her foot.

"You see, now I'm putting my hand inside the clog. It catches here; it scratches there. Another touch of the shaper. And the gouge trims what you run it over. Sharp as a razor, the scorp (a cutting hook), digs the bottom where you can't see.

"I'm about to finish up," Mr. Fauchon says. "Look, you can see toolmarks all over the clog. I'll get rid of these sharp edges and lines. You take a simple knife, like your pocketknife, and whittle away the sharp edges. And after you've cut, scraped, and rubbed with a pumice stone, you have a round clog. Pretty—you'll laugh—as a barge!

"The gouge makes it possible to give a sharp contour to the outline of the heel. With the scorp I can carve a flower, a head of wheat on the upper part. Here you are."

"Thank you, Mr. Fauchon. But I would like to order a pair of ordinary clogs."

"Oh! I like that. Please take off your shoes. Place your feet on the two boxes. I'm going to measure your size. OK. Nine. Let's see. Here's a pair. Try them on. The left one is tight on top. The right one squeezes your toe. Just a touch with a tool and I'll take care of it. There, these will feel better. You see, even after the clog is finished you have still to adjust it.

"I've heard you have a house on the hill. Once you get used to it, it feels good to wear clogs. They don't sink into wet ground. Your feet stay dry. Take them off when you enter the house; then you put on woolen slippers.

"And I'm going to tell you something else. You can hear clogs coming, and that's not so bad. It's called 'clogging.' Making a sound with clogs.

"I see you've been looking at the shavings. I take them to the baker. He uses them to start his fire. He gives me a brioche when I bring him a bag."

"Thank you, Mr. Fauchon, for making a pair of clogs for me. They're wonderful! And the explanations—I feel I could make a pair myself."

Mr. Fauchon puts his hand on my shoulder and says as I leave, "Our profession isn't only making, but explaining, passing on. I was an apprentice once. I remember. If you want to be my apprentice, all you have to do is ask."

"Yes, Mr. Fauchon. But I have to visit the blacksmith now."

"Oh! Him too!" Mr. Fauchon responds.

The scorp, which comes in different shapes, is used in a number of professions to cut a surface.

Making a Barrel

The cooper's hammer, used to cut and tighten barrel staves.

Opposite: The making of an Armagnac cask.

A barrel, or cask, is a cylindrical vessel, flat at both ends, with a bulge in the center, made of twenty or so staves held in place by metal and wooden hoops. There is an identical round base at each end, and in the middle of the bulge is a bunghole corked by a wooden stopper.

A barrel is used to store and transport wine and alcoholic beverages. In ancient times, jars and amphorae served the same purpose; many have been found in shipwrecks at the bottom of the sea. Wineskins made of goatskin were used to carry small quantities of liquid.

The Gauls are credited with inventing the cask because they discovered that heat made it possible to bend a wet board in the middle. There are barrels, identical in every detail to our own (arched sides, wooden hoops) in a Gallo-Roman bas-relief (hauling scene on the Durance River) from the age of Augustus (63–14 BC), preserved in the Musée Calvet in Avignon, France.

There are a number of advantages to using a barrel, some of which are obvious at first blush and some of which become apparent only with use. First of all, these vaulted vessels have an indisputable solidity. As a result, they are easy to handle, as anyone who has seen them transported can attest, for their curve means minimal contact with the ground. They are easy to roll and to maneuver, and they can be moved by anyone.

The curved shape makes it possible to keep the amount of air between the surface of the liquid and the top wall to a minimum. This fact is significant for alcoholic liquids that have to evaporate naturally in the barrel (the famous "angel's share" of Cognac) and not in the air. The bottom half concentrates the sediment, preventing it from mixing with the liquid when the liquid is decanted or pumped out.

The cooper's bar dog makes it possible to lift a stave to fill a space around it.

Over the course of time, many types of wood have been used to make barrel staves: chestnut, ash, acacia, white birch, willow, beech, pine, poplar, white oak, mangrove, eucalyptus, and elder, among others, though the first two are clearly preferred.

Cognac, Armagnac, and whiskey are always aged in oak casks, known for their ennobling powers.

Pine, poplar, and elder barrels have been used to store products such as fish, salt, butter, saltpeter, sugar, and wax, which are unaffected by these woods' lack of tannin.

The operation begins. Once the tree has been felled, it is cut into sections the height of the required staves. These blocks used to be cut with a pit saw, while today the ubiquitous chain saw is used.

After having closely examined the wood, workers adept at avoiding knots and imperfections mark where they will place their wedges on the flat surface of the log. In order to bend properly, the staves must be cut with the grain of the wood. This keeps them from warping in use.

Driving steel wedges into the wood splits the trunk into quarters. Then another tool is used to split the wood, though it is not sharp. It is shaped like a square with a long horizontal piece of iron and a vertical pole that is a short wooden handle. On a worktable, the worker swings the splitter like a mallet to split the quarters lengthwise.

After this initial rough-hewing to eliminate unneeded wood—following the guiding principle of all sculpture made by cutting (that "the heart of the matter is inside")—barrelmakers take up a froe, which looks exactly like a splitter, though it is better suited for finer, more precise work because it is sharpened.

The rectangle of timber reaches its actual future size once it is fixed to a horizontal horse and planed. As its name indicates, the plane—a very sharp knife workers pull toward themselves between two knob-like grips—smoothes the surface of the staves.

The first phase of the barrel story ends at this point, temporarily. Actually, the timber is best when it is dried, so the boards are stacked in the open air and left for three years. It makes little difference if it rains, because, as a saltworks employee told me, it isn't so much the sun that does the trick, as the air and the wind. The wood is aged for three years, which is not long compared to the twenty years the oak for masts was required to remain in a pond before it could be used on ships for the French royal navy.

It used to be that the customer who commissioned the barrels might specify that they be made "using the adze," because, apparently, wine kept in adzed staves aged better than those smoothed with a plane. The barrelmaker set to work armed—the word is well chosen here—with an adze. This adze is a type of ax about 16½ inches from end to end, about one foot of which was blade. The blade was between 4 and 6½ inches wide. The edge is beveled on only one side. In order to keep the worker's hand clear, the handle was shifted toward the right and turned downward. The end, which is larger than the rest, leans on the worker's leather apron. The tool weighs from 11 to 20 pounds, and is grasped by the top of the handle next to the socket. It works by its weight. A little like the trimmer or the clogmaker's hatchet, this tool is raised, and its fall is guided so as to leave a huge wood shaving. Adze users were often so skillful that they could finish a stave using just this one tool.

However, as barrelmaking is a profession requiring precision, sooner or later measurements need to be taken. A miscalculation made during one of the early phases of construction can result in the vessel not being watertight. If this happens, it means you have to take it apart and start over.

A stave from an old barrel is used as a standard, and the cask's twenty (or thirty, depending on the type) staves must be sawed to exactly the same length. Also, leaving behind its beginnings as a simple board, the stave receives its new, curved form. A special plane is used to give it that

A plane is used to dig the croze, the barrelhead groove.

outer roundness, and the curve is checked by a profile gauge (a stave-length board cut into the ideal shape).

Using a back knife, a cooper rounds the stave's concave inner surface.

By this point, when seen from the side, the stave clearly shows the desired curved form. What remains to be done is to taper the two ends so that, when put together, the staves will create the rounded barrel form.

The cooper gets behind the long jointer, a large plane with a beam frame and a blade turned toward the user, who works it by pushing the stave downward. Actually, one of its ends rests on the ground while the other rests on a horse. The plane works upside down: the massive tool remains stationary while the piece of wood is pushed along the blade.

The next steps are assembly and shaping. Working on perfectly flat ground, coopers stand the staves up in a circle, making sure to alternate narrow and wide ones, and the time comes to put on the iron hoops. Coopers put a small brazier filled with shavings and small pieces of wood on the ground inside the barrel. After generously moistening the inside and outside of the staves, they light the fire and then close the base of the barrel, bringing together the ends of the staves. In the eighteenth century, this step was performed using a trusser, a wooden device with handles and a rope attached to a vise. Today, a capstan does the tightening. A steel cable attached on one end is fit around the base of the barrel, and is then wound around a hand or machine winch. The fire is lit, the wood moistened evenly, and the cable slowly tightened. The cask takes shape. It is turned around, and the worker places the different metal hoops around the barrel.

The cooper, who wields a wide variety of tools, strikes a barrelhead with his mallet.

These metal bands are fastened with rivets and are moved along the outside of the cask by a small iron tool called a hoop-set. The curve starts at the bottom, where the hoops begin. At the top of the barrel, a worker hits a punch (similar to a cold chisel) with a small hammer around the entire circle of staves.

The coopers now shape the ends of the staves and prepare them to hold the bottom of the barrel.

First, using an adze, they cut a bevel on the inside of the top of the staves. The cooper's adze, a descendant of the tool the Romans called "ascia," is a large rounded hatchet, a short massive tool in which your hand seems to disappear. The barrel is placed on a slanted frame and the worker wielding the shearing adze slowly turns the barrel as the work progresses.

Using the stockholm, a rabbet plane with a curved body and convex blade, the worker digs a circular groove, the croze, on the inside at the top of the staves. This is meant to lend stability to the cask by creating the horizontal lines of resistance parallel to the bottom.

The bottom will sit in this croze. The worker marks its position using a small wooden instrument, the marking gauge (a portable square ruler with a tip that draws with a wedge). The plane used to dig the croze is set accordingly. The worker pushes it along the edge of the barrel, resting obliquely on a horse.

Working slowly, with the help of a compass, the cooper determines the radius of the barrelhead. Masters in the art of curving wood, coopers use a caliper made of a small wooden board shaped like a hairpin. The base of this inverted U contains a central grip, with which the two metal points can be moved closer or farther apart. Starting with a reference point, coopers track the points of the compass along the inside of the croze until they find the starting point six times, which reveals the radius of the barrel end, or heading. The circumference is drawn on the surface of five boards placed on top of each other and cut by a jigsaw, an adjustable tool that is drawn up and down to cut a corner with the frame axis.

The edges of the heading are beveled with a plane. The cooper works the surface with a special small plane pushed in the middle of two lateral horn-shaped grips. The two heading bevels must not come together at a stave joint, or there will be a space between the barrelhead and the croze.

The outer hoops are removed using the hoop-set. The stave ends move apart, leaving room for the heading to be inserted. If some wood is missing in a croze, the cooper fills the area with a small piece of cane by pulling the stave with a lever with a movable joint. This tool is called a ratcheting hook, or bar dog.

Using a hammer on the outside of the staves, the heading is fit into the croze, and the hoops are replaced.

This is an individualist in the huge family of planes: it cuts in a circle.

Opposite: Depending on the task to be performed, the barrel is placed vertically or on its side.

Wooden hoops are added to the iron hoops, to protect the barrel during transport and when it is rolled. These are made of bent chestnut branches. Using a piquet, a type of ax with a long square blade, the cooper cuts notches in the hoop-to-be to insert a willow spline or an iron wire. A mallet—a hardwood tool—not a hammer, strikes the hoop-set used to position the hoops.

Some steps have been left for the end. If the customer wants the barrel to have a spigot, the barrelhead will be drilled with a large tool called an auger. The bondonnier, which looks like a very large gimlet shaped like a funnel, is used to drill the bunghole in a particularly sturdy stave chosen for this purpose, known as a bunghole stave. Wrapped in a piece of canvas to insure that it is completely watertight, the bung, a small round piece of wood, will be driven using a mallet. To remove it, you use a bung puller, a corkscrew turned by an iron stirrup supported against the stave.The time has come to test the barrel. Ten liters of boiling water are poured into the cask, and it is turned in every direction; any oozing or leaking will be immediately fixed with small pieces of wood.

Before releasing a barrel, coopers trim the part of the peg protruding from the stave. The final step in building a barrel, its "seal of approval," as it were, is the worker's (formerly master cooper's) signature on the barrel. He engraves his name using a graver. This tool has been ingeniously designed to draw all the capital letters of the alphabet. A very sharp gouge is used to carve bars; a tip acting as a compass point serves as an axis for a perpendicular gouge that will mark the curves of the letters.

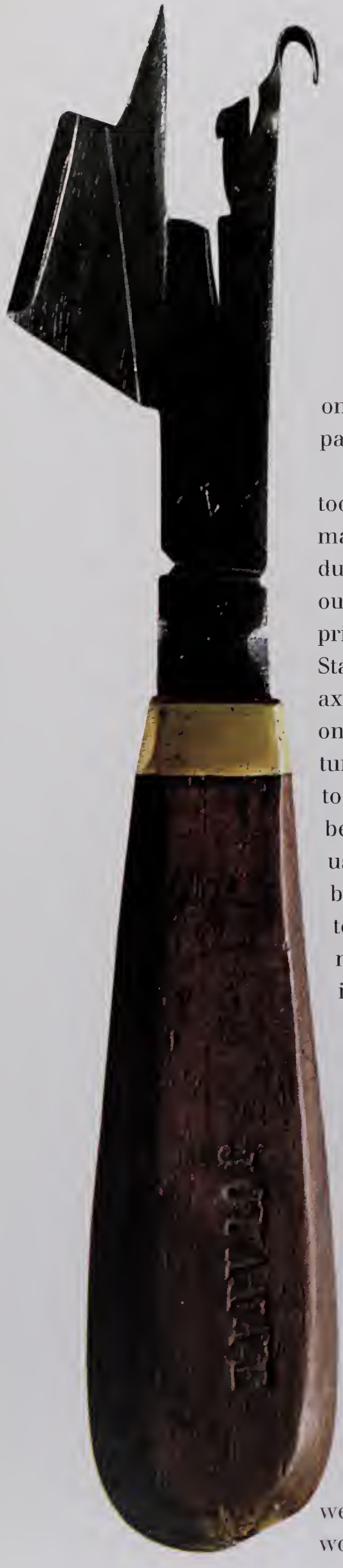
The barrel now approaches its fate. Many cooper's tools have been replaced by mechanical tools or by machines, but the principle of constructing a barrel remains the same and the sequence of operations is unchanged.

Opposite: **The strange world of barrelmaking, where the curve reigns supreme.**

Even if fewer barrels, casks, tubs, and other vessels are used now than in their heyday, there is still a demand for wooden barrels. For a long time to come there will still be people who cut, bend, put together, and hoop staves to bring about the miracle of watertightness in a vessel whose form has not been changed or improved in two thousand years.

This review of the cooper's impressive collection of tools would not be complete without a closing remark. Building an ordinary barrel requires using all of these tools, one after the other. And coopers, whose occupation and fascination are with measuring and precision, keep not just these tools on their wall; they have a whole array of other tools as well, suited to creating larger, smaller, and just different objects.

The list of the items that comes out of a cooper's workshop is indeed impressive: troughs, bathtubs, tubs, churns, kegs, small casks, drums, buoys, tankards, vats, funnels, tumblers, flasks, baskets, pitchers, buckets, tables, barrels, vases, vinegar cruets. And when you hear coopers list their eighty tools, you hear their regret at not having more—one that would be perfect for this job or that job—even if it were used only twice a year. Coopers are like that.



Tool Marks, Marking Tools

To mark is to place the most lasting sign possible on an object, stating one's ownership or indicating its place as part of a whole.

There are two kinds of marks used on tools. The first and most common are those made by the toolmaker, the one who produces a tool with sharp cutting edges and, in our times, the mark of the industrial enterprise that holds the patent on the tool. Stamped deeply into the flat surface of the ax blade, on a side of the hammerhead, or on one of the grips of a pincer, the manufacturer's name is like an advertisement. If a tool is worn out or lost, users will remember the mark they have seen so often while using it. And anyone who appreciates a borrowed saw or billhook will know where to find the same one. Marking of this kind, made with a marking iron bearing a name, is not available to just anyone.

Nonetheless, people do occasionally want to put their names on their tools. They don't usually bother with simple tools like axes, billhooks, saws, or hammers, being more concerned with "personal" tools such as a cooper's graver or a cabinetmaker's decorated plane, which may even be dated. The letters and numbers are hammered using punches, heat-marked using a metal stencil (some cabinetmakers have used this method), or engraved with a gouge. The last and first name, last name only, or just initials may be included.

In certain professional groups, tools were used to mark the material being worked on. The best-known example—which anyone even the least bit curious has probably noticed—are the stones of European churches and cathedrals (especially Romanesque and Gothic), which bear the marks of the workers.

Stonecutters chose a personal sign. Of course, there is an infinite variety of possibilities, from an uppercase or lowercase worker's initial to a number, a figure eight on its side, a spiral, a circle, a square, a cloverleaf, a heart, and so on. The site foreman would check the signs on a row of cut stones to calculate the wages due each worker at the end

of the day. In some churches, you can make out almost all of them—indifference on the part of the builders or homage to the workers? In other churches, they are not so apparent, but this does not mean that they did not exist. All you have to do is look for them on the marked side of the wall.

Of course, these marks have been studied. They have been used to track the movements of some laborers and to uncover relationships between buildings.

Location marks are different. These were made by the master builder of the cathedral and indicate the proper location for the various component parts of a building, such as statues on a porch, by using letters and Roman numerals on the wall to correspond to those on the back of the statue.

The idea is the same as the one carpenters use when they assemble a frame. The different parts are marked according to their position left or right of the central axis of the structure and according to the area where they are supposed to be placed.

The mark of a toolmaker.

After removing a small area on the tree to be felled, the forester turns around his hatchet to mark and stamp the owner's letter or distinctive symbol.

The cooper's graver is used to "sign" the barrel with the workshop's name as well as the name of the artisan, but also to claim responsibility for repair in case the vessel ever leaks.

Crates and containers are marked with the names of the senders and recipients, not to mention other information, using stencils, small punched-metal sheets with which you can produce well laid-out letters and numbers.

In Argentina, France, Mexico, Spain, and elsewhere, livestock is branded using a red-hot iron in the shape of the owner's letter or symbol.

Breeders in Madagascar have a simpler approach. They mark the ears of their cattle. As each later transaction occurs—purchases, inheritances, trades, or dowries—relevant marks are added, making it possible to trace the animals' legal status.

Visible only to those in the profession, clockmakers frequently engrave—delicately but firmly—their name and the date of repair on a clock frame. In this way, the instrument for measuring time bears its own history, as well as the name of the artisan to whom it can return to be at home.

Opposite: **Marked with its owner's name, the graver is used to "sign" a barrel.**

Center: **A workman's mark on a stone of the Pont du Gard in France. Paid by the piece, he left his mark on each stone he cut.**

Adze-Eye Wooden Turning Chisel

MOROCCO

The deep oval wear-and-tear mark on the left side of a tool's handle reveals an unusual use for an adze. The same goes for the widening at the handle's base. In fact, this tool is not used to carve wood or to plane a beam as an adze usually is. It is used in Morocco (Marrakesh) by a chair-maker. To make a piece of wood tubular, the artisan begins with a fairly heavy tool

that will not jump when struck, as a gouge might. The heel of this elegant tool, with its rudimentary but solid handle, is used against the lathe frame as support. The side of the handle has been worn by the unlathed part of the wood rubbing against it.

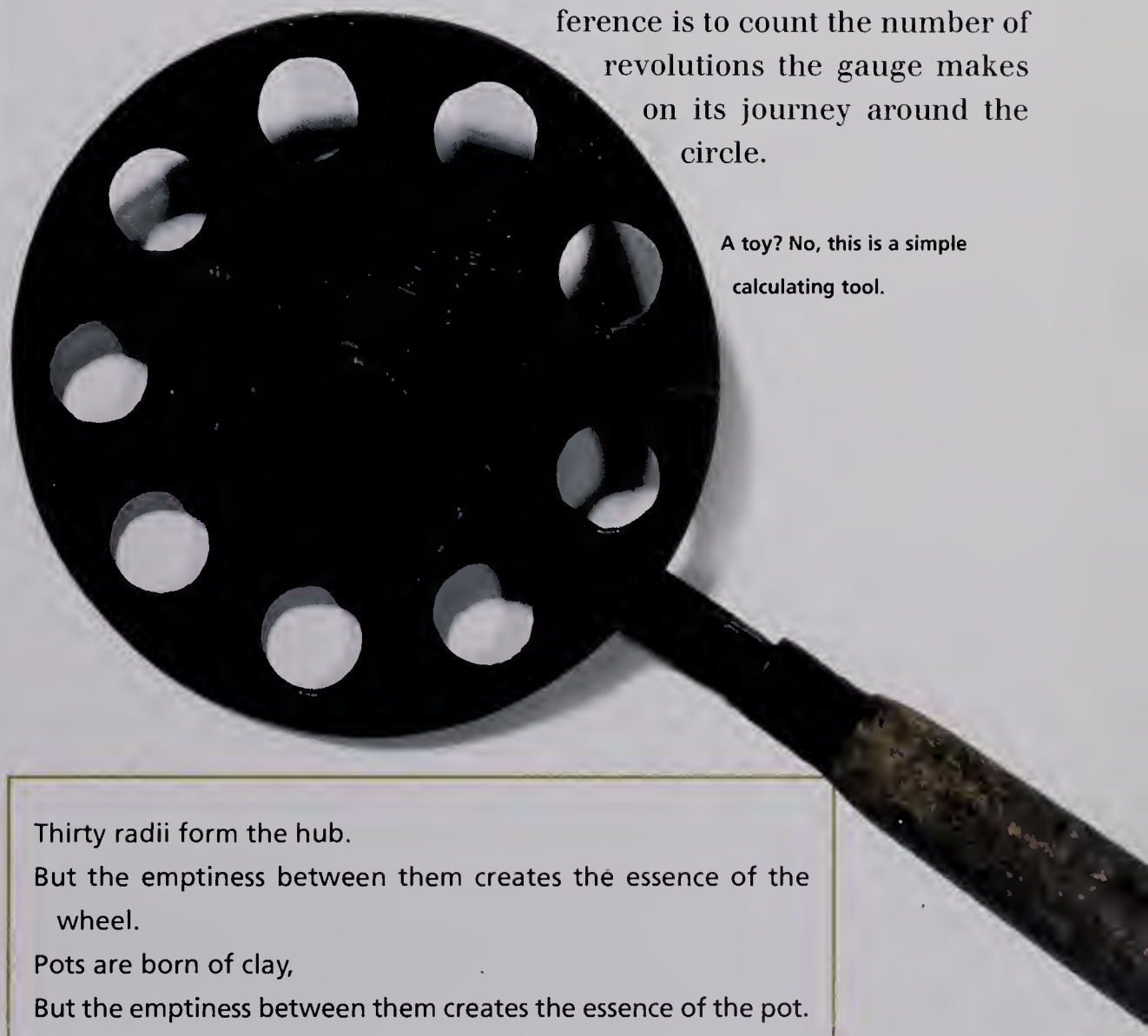
Then, if the lathe axis is on the ground, fine handheld gouges are used, which are held in place with the foot.

Cérès

Wheelwright's Wheel Gauge

The delicate job, performed under heat, of fitting the rim on a wagon wheel.

Part of a wheelwright's set of tools, this ingenious instrument makes it possible to measure a circle and then copy the measurement. The wheelwright marks a starting point on the wheel rim with a pencil or sharp point, aligns the mark on the gauge with it, and runs the gauge around the outside of the wheel. All that needs to be done to ascertain the wheel's circumference is to count the number of revolutions the gauge makes on its journey around the circle.



A toy? No, this is a simple calculating tool.

Thirty radii form the hub.
But the emptiness between them creates the essence of the wheel.
Pots are born of clay,
But the emptiness between them creates the essence of the pot.
The walls with the windows and the doors form a house,
But the emptiness between them forms the essence of the house.
Fundamentally,
Matter contains use.
That which is not matter contains essence.

Lao-tzu (sixth century BC)

The Billposter

Does the cellulose in the poster remember that it was once a tree in the forest?

Agility has to work hand in hand with a sense of balance.

This is a profession that makes extremely economical use of its resources. In fact, once you have counted the spud (a kind of knife with a trapezoidal blade), the bucket containing liquid glue, the long brush with flexible bristles, and the ladder, you've listed all the necessary materials.

In order to avoid pasting new posters on top of old ones, billposters prepare the surface with the help of the spud, which lifts the edge of the old posters and tears them off in long strips. If a piece sticks out, the workers can pull out a notch in it to create a support for a new strip of glued paper.

Not a workbench, the wall itself is a working surface. Just think—the glue provides good adhesion for the poster on the wall. Meticulously, quickly, the worker runs a brush covered in glue over the back of the poster, section by section. The time has come to paste the entire surface to the wall, carefully aligning it by looking from side to side. The brush caresses so the moist paper will become one with the surface of the wall without leaving wrinkles. If a large poster consists of a number of parts, billposters carefully take their bearings and, if necessary, can miraculously remove the paper from the wall to adjust its positioning without tearing it.

A final touch of the brush, to set the mind at rest. The billposter has to leave things the way he found them and remove the large roll of paper wrinkling under his arm. The brush rests in a case attached to his belt. The bucket in one hand, the ladder in the other, the man is already gone, in search of the next billboard.

VÊTEMENTS de SPORTS EXPORTATION
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TENNIS PLAGE etc

PROPRIÉTÉ DE L'AGENCE NATIONALE D'AFFICHAGE

100 SUCCURSALES EN FRANCE

NATIONAL

BANANIA

VOUS-ZVOUS

SUZE SUZE

SUZE SUZE

CAOUTCHOUCS

MARQUE A L'AIGLE

MARQUE A L'AIGLE

NCE NATIONALE D'AFFICHAGE

BRUXELLES

Aux Petits Agneaux

PARIS

EXPOSITION GÉNÉRALE DE MEUBLES DE STYLE

BRASSO

POUR MÉTAUX

PROPRIÉTÉ

BARAQUES BARAQUES

280 280

Le Chomage et l'Epargne

VIEILLE BOUTEILLE A UN PRIX DISCRET

The Cabinetmaker

Cabinetmakers transform boards into windows, tables, doors, armoires, or shelves. Their collection of planes—from the tiny molding plane to the heavy try plane and the very long smoothing plane—allow them to sculpt a round corner, a right angle, or a molding along the entire length of a piece of wood. In fact, the plane, made of a block of wood and a sharpened edge placed at an angle and held by a cap iron, could be called "the equalizer." Correctly set, it removes material lightly and evenly, creating a perfectly smooth area or a continuous surface, leaving behind a trail of shavings.

Different saws allow cabinetmakers to cut boards, thus defining the work surface. Chisels and gouges, carefully struck using a mallet, make fine woodworking possible.

TOOLS, MOTTOES, AND EMBLEMS

In the fourteenth century, Louis, Duke of Orléans, burning to defeat his enemy John of Burgundy, took as his emblem a gnarled stick and the words "I send it." He didn't have to wait long for an answer. The symbol John the Fearless adopted was a plane with the words: "I have it," thus indicating how he would defend himself against the stick.

Previous pages: **A cabinetmaker at the A. Lulli studio in Paris using a box miter; and a molding plane, a plane in which the blade and the body are the reverse of the molding to be cut.**

Left: **The cabinetmaker uses a dozen specialized tools, one after the other, for the same work.**

Below: **Another modest artisan's object. Who invented this box with slotted sides for guiding handsaws?**

Miter Box

The cabinetmaker, the parquet installer, and the picture framer all use the miter box, which, simply put, is a saw guide. A board or strip of wood is put in this slotted box with its two raised sides; the slots guide the saw for cutting at right angles and diagonally. All you have to do to cut the wood at the desired angle is place the saw in the appropriate position and start cutting.

Ancient Egyptian Artisan's Toolbox

From the colossal statues still standing to the glass pearls on necklaces to the gold masks to the simple cane chairs—all of the technical products of ancient Egypt were made using a limited number of relatively primitive tools.

The paintings and bas-reliefs showing artisans at work provide a catalogue of tools and a description of the artisans' movements, but they also tell us about the way work was organized. These images tell us that starting in the Old Empire (2640–2155 BC), individual work at home gave way to collective production in workshops where various professions coexisted. Applying the new principle of the division of labor, each artisan performed a single job from the series that would result in the complete object. This led, of course, to complete mastery of the step, great speed, and, surely, an ongoing trend to lessen effort and improve quality and production.

The agricultural wealth of the country—the "gift of the Nile"—and its inhabitants' standard of living help to explain the ancient Egyptian's tremendous output of objects of every kind, as well as their technical perfection. In a world in which time didn't exist, skill and patience did the rest.

From the Neolithic to the Mesolithic Period, all tools were made of flint, bone, and wood. Flint—readily available as flakes in terraced formations—was cut into small chips using a stone percussion tool to produce a continuous or serrated blade, depending on what was needed. During the Neolithic, toolmakers moved from flint knapped into rather fragile flakes to much stronger polished hard stone.

The Egyptian cabinetmakers' toolbox contains a small number of tools combining techniques and inventions from different ages. Mallets were made of a single piece of wood in the shape of a drumstick, and side scrapers were made of flint. Starting around 2500 BC, the blades of saws, axes, hatchets, knives, chisels, and gouges that had been made of wood began to be fashioned out of copper. In the Middle Empire, this metal was replaced by bronze, and in the New Empire (between 1500 and 1000 BC), further progress was made with the introduction of the bow drill. The worker operated the drill by holding the grip in one hand while pushing and pulling a bowstring wrapped around the shaft with the other.

The ax had a crescent-shaped blade whose tail was inserted in a

A copper-blade adze from ancient Egypt. Its design indicates the motion with which it is used.

groove in the handle and held by straps. It was used to rough-shape.

The saw, which did not have a frame, was like our present-day handsaw, and was used to cut a trunk into boards. The adze could be used to rough-hew a wood statue as well as prepare a beam or plane a board similarly to the way we use our planes.

Different pieces of wood—a rare material in that country—could be assembled using dowels, tenons, and mortises, and held in place with vegetable glue. Glued cloth, stucco, and, finally, paint covered the joints.

Skill and ingenuity made up for the dearth of resources. Bas-reliefs show metalworkers transporting crucibles filled with molten metal on simple bent poles. In the New Empire, the invention of the foot- or hand-operated bellows (two leather bags attached to the ends of a Y-shaped wooden tube ending in a metal tube), transformed the life of those who worked metal.

Once again, the matter has to be examined carefully. We recognize the unique form of the ax at a distance of four thousand years. However, when we read in the museum catalogue that its blade is copper, we hesitate. How can such a soft metal be used for cutting? We live, as it were, in a world ruled by iron and steel. We have to remember that the same word does not mean the same thing over time, and that the shape of an object should not influence the density of its components and their chemical properties. The copper deposits of ancient Egypt were in the western Sinai. The mineral, naturally mixed with other metals, provided an alloy much tougher than our current industrially refined metal. An analysis of the copper objects in the tomb of Princess Khekeretnebty in Abukir (Fifth Dynasty, 2465–2325 BC) show the presence of arsenic, bismuth, iron, tin, silver, nickel, and antimony.

Bronze, an alloy composed of 90 percent copper and 10 percent tin, must have

Egyptian cabinetmakers at work in a tomb in Thebes.

come from Syria between 2000 and 1600 BC. It was generally used between 1500 and 1000 BC.

Iron, which came from abroad or from meteorites, seems to have been forged for the first time in the Greek colony of Naucratis in the sixth century BC.

Tools can be seen as typical forms (ax blades), as structures (the assembly of the hammerhead and its handle is a good example) which, once they have found their ideal form, their balance, give the illusion of permanence and timelessness. Their solidity, their use depends on the raw material employed in their creation, whether it was found by accident or cleverly worked out.

To work stone—which was sometimes granite—the artisan used heavy copper chisels. A helper regularly sharpened the tools and held them over the fire to harden them. Dolomite balls were used to polish the surface of the stone rough-hewn by the chisel. The chisel could be struck with a pounding hammer whose handle consisted of two sticks tied together around a six-sided stone. The stone head was held in place at the end of the handle by a knotted X-shaped strap wrapped around it.

Our list would not be complete without the indispensable accessory tools used to give the vertical (the plumb bob), the horizontal (the level shaped like a capital A), the right angle (wood square), and the circle (two wood pegs tied together by a string). The simplest ideas produce unquestionable results. Filled with water—which will always present a perfectly horizontal line to use as a guide—a ditch dug around the perimeter of a monument to be built (pyramid or temple) guarantees that the structure's base will be horizontal.

STONE

An Egyptian Quarry

Near Aswan, Egypt, an immense granite tablet bears the marks of human labor. Round holes drilled in the stone at regular intervals form a line that marks the beginning of a cut for an obelisk; the project was later abandoned. The Egyptian engineers and quarrymen had the perspicacity to take advantage of a tremendous force that can be unleashed with almost no expenditure of energy. Dry wooden stakes were stuck in the holes in the rocks and held tight with wedges. The wood was sprinkled with water, which made it swell. Its change in volume caused the stone to crack along the line traced by the holes.

This approach—which evinced a certain amount of shrewdness and patience—accomplished what couldn't be accomplished by force. We can imagine that the discovery of the principle that wood expands as it absorbs liquid came from observing nature (tree roots can dislodge even the heaviest stones in a wall) or by accident (a wedge stuck in a stone soaks up water and eventually breaks it).

Anatomists are well acquainted with another application of the same principle. The fused bones of the human skull cannot be separated simply by pulling on them. But turn the skull upside down and fill it loosely with seeds or beans—lentils, for example. Add water, and you will see that the force they exert as they expand soon wins out over the very great power that holds the bones of the skull together.

An Egyptian quarry. Dotted lines created by human intervention can be seen in the mineral block.

Stonecutting Tools

Work is a struggle. When it's metal against rock, metal wins. The answer to the question of which will win out is always the same. The builders of ancient Egypt used stone tools, which owed their effectiveness to their hardness: the blades were made of flint, dolerite, and quartzite. The handle, made of wood with leather straps tied around the stone, absorbed the force of the mallet blows, dampened vibration, and lessened the force of recoil to the worker's hand and arm.

Often, the family of tools for a certain profession is centered around a simple objective, and indeed, whether they are violent (like the wedge) or patient (like the saw), a woodcutter's tools are used to cut wood.

With no exception, all of the stonecutter's tools are used to remove material. Like the oak, a cliff is too big for human hands; it must be cut, removed, reduced. You will find that stone tools hardly differ from each other and are little evolved, compared to those used for wood. These cutting hammers are equivalent to axes; rock saws, which can cut a groove in the rock, correspond to wood saws. And, to extend the comparison, the woodcutter can be compared to the quarryman; they are both at the source of the raw material, that is, completely upstream. The woodcutter has something of the carpenter in him, and even something of the cabinetmaker as well.

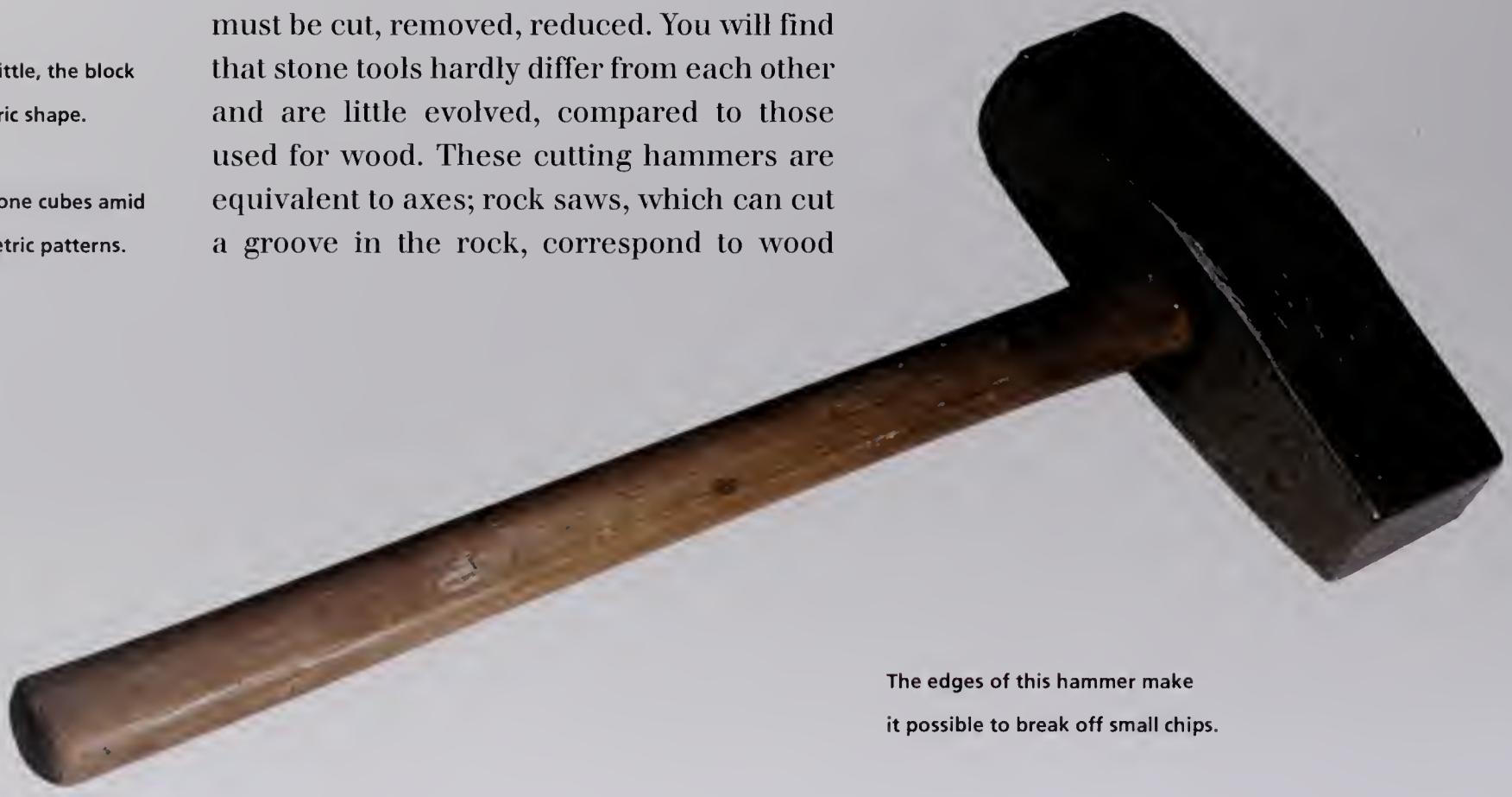
Stonecutters not only cut stone into blocks, but they also dress their outer surfaces. They can carve an ornament into a piece of marble in the same way a cabinetmaker works wood, and they can turn a baluster just as a cabinetmaker would with a lathe.

Stoneworker, woodworker—each will immediately recognize the tools belonging to the other, for their shapes authoritatively assert their purpose. And no one would try to scrape away stone with an ax or plane a board using a stone rasp.

While the work of an ivory sculptor is on a constant scale and is seen at a constant distance, the stonemason may have to dress a facade's facing (seen from afar) as well as the individual pieces of the ribs of a building's vault. That is, to put it simply, the massive and the delicate, or, as they say in the world of business, wholesale and retail.

Opposite: **Little by little, the block takes on a geometric shape.**

Overleaf: **Cutting stone cubes amid the quarry's geometric patterns.**



The edges of this hammer make it possible to break off small chips.

Opposite: **Stonecutting in Asia. Different position, same principle.**

It should also come as no surprise in this list of stonecutter's tools that we will find some that perform more or less the same functions but on a different scale. Of course, they also differ in their general shape and the appearance of their edge.

They fall naturally into several categories.

First, there are tools used to strike stone, used the way you would wield a hammer or an ax. The two heads of the metal part form a right angle with the wooden handle.

Then there are the tools that are held (usually by the left hand) against the stone and are struck at the end of the handle with a metal tool held in the right hand, such as a mallet.

The different shapes of these two types of tools make it possible to further subdivide the function of those from the first category to combine the same amount of power (the blow of a wooden or metal-headed mallet) with greatly increased precision.

Then there are tools that are pushed along the stone surface like a plane or file on wood or a file or saw on metal.

The group of tools operated by rotating will be considered separately.

We will also discuss the tools used with the lathe, the machine used to make cylinders and rounded shapes.

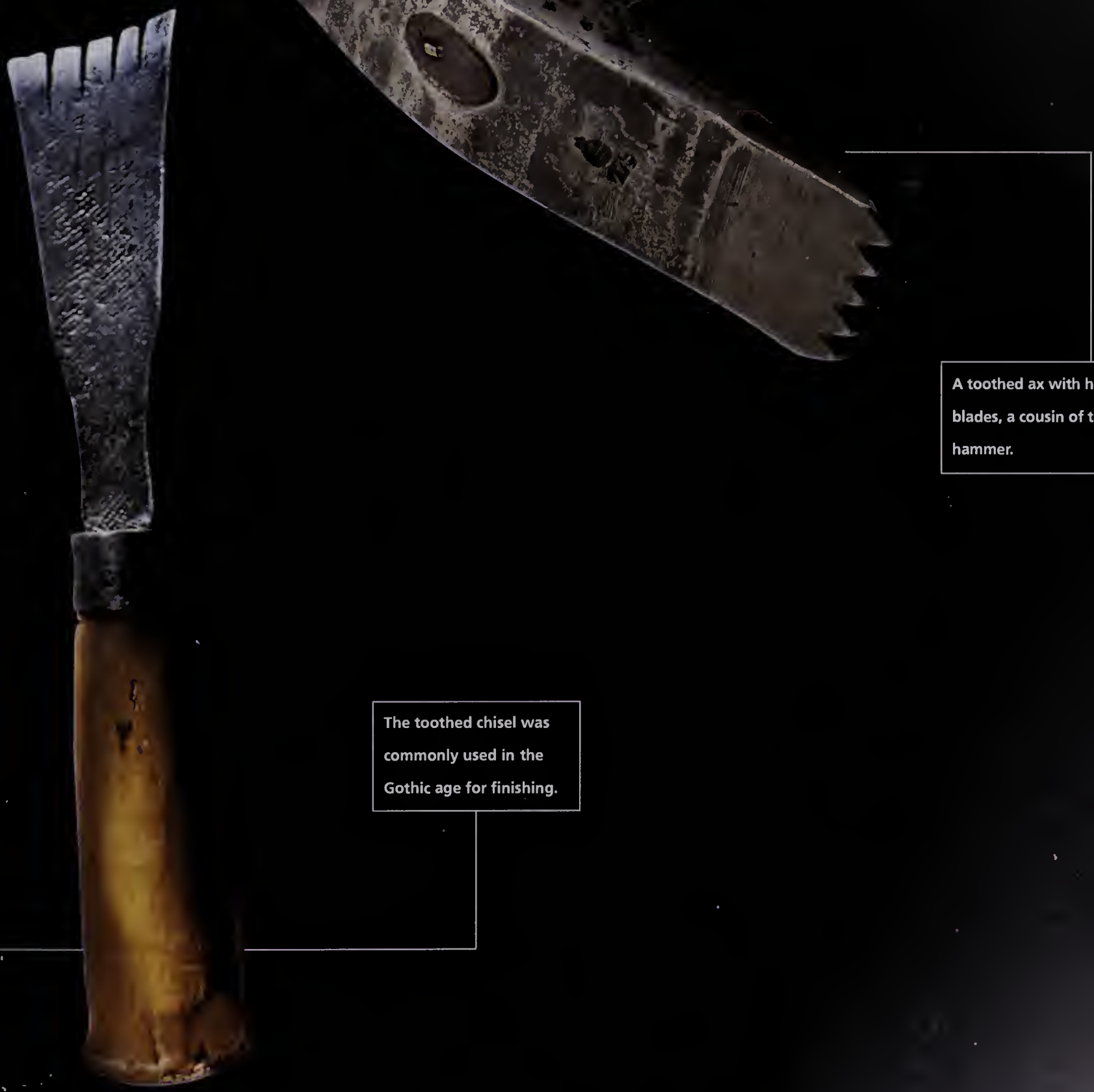
Finally, to complete the description of the various processes, we will mention the stonecutter's indispensable ally, a type of catalyst—the abrasive.

The stonemason's pick (or "smille," originally from the Greek, meaning "cutter") owes its name to its two pyramidal steel points. Its solid-oak handle is about a foot and a half long. This very heavy tool was wielded with two hands and struck with powerful blows. It could be used only on blocks heavy enough not to be moved by the blows. This tool is no longer used by stonecutters because the blocks delivered to their workshops these days are already rough-hewn by machine.

The peen hammer is used to remove material from a squared block.

The flat chisel is the most common stonecutter's tool in the world.

Shaped like a spoon, the gouge digs into stone.



A toothed ax with horizontal blades, a cousin of the bush hammer.

The toothed chisel was commonly used in the Gothic age for finishing.

The stonecutter creates a straight line of weakness within the uniformity of the block.

There is a type of stonemason's pick with removable steel tips held in place by a bolt. With this design, the artisan can always remove and replace dull tips and doesn't run the risk of having to stop working if a new one is needed. The tool is used to rough-work blocks of stone, to square them off (that is, to reduce them to a block), and to make a cut in a large block in which to drive wedges.

The pick is shared by two professions. It may be the last tool the quarryman uses after extracting the stone and the first one the stonecutter turns to before going on to finer tools.

The sledgehammer. The only thing hammerlike about this tool is its T shape. In fact, this metal tool has two steel heads, each with a digging face. It is used parallel to the block to remove any material extending beyond a desired point. Designed to produce a straight line, it marks out the block's edges. It too is a transitional tool between the quarryman's and the stonemason's areas of responsibility.

However, the stonecutter does not repeat the same movement with the same tool all day long. Like all work, stonecutting requires the use of different approaches (or attacks) and various means. The tool with one curved end is also called a sledgehammer, since the name comes from the

size and weight of the head, regardless of whether one end is used as a pick or the head is a double peen.

Many stonecutter's tools are composites, which makes it easy to go from one step to the next once the first has been completed.

The peen hammer, with its two straight steel blades parallel to its handle, could be mistaken for a two-headed ax. It is used to remove layers of soft stone and plane its surface using close short blows. It is also called a spalling hammer.

The polka, a type of patent or facing hammer, is a variation of the peen hammer, except that the two edges are perpendicular to each other. Some polkas have two horizontal blades. This tool is used to cut stone in places other tools cannot reach. It can be employed especially to open a layer of stone between two cuts of a stonecutter's saw.

There is a variation of the polka called a mill pick. It has narrow edges and is used to recut very hard millstones.

The toothed ax, a cousin of the peen hammer, has sharp, elongated steel teeth. It is quite heavy and is used to dress the surface left by other tools. The teeth for which it is named are perpendicular or parallel to the handle.

There is a type of toothed ax called a crandall. Each end is equipped with a dozen removable teeth at the end of pyramidal points.

The bretture, or dog-tooth hammer, is a type of peen hammer with at least six flattened teeth made of high-tempered steel. Used in the same situations as the toothed ax, it produces finer work.

The bush hammer leaves behind a mark well known to anyone who has looked closely at the facade of a building. The tool is a short, heavy hammer with steel ends holding a series of diamond-shaped points. The points usually number at least twenty-five or forty-nine (five rows of five or seven rows of seven), though there can be many more (up to several hundred on old tools).

Originally forged, the head of the bush hammer tool is now cast. The bush hammer has made something of a comeback recently. It used to be used to remove the uneven surface left by a point, whereas it is now used to give a grainy texture to a wall smoothed by mechanical sawing so that it will absorb light well. In short, instead

The metal-headed mallet and the point work together to perform a single operation in the surest way.

of removing roughness from the stone, it sculpts it.

Like other stonemason's tools that suffer from use—this tool is swung hard with two hands—the bush hammer sometimes has replaceable heads that can be changed depending on how worn they are and the work to be done.

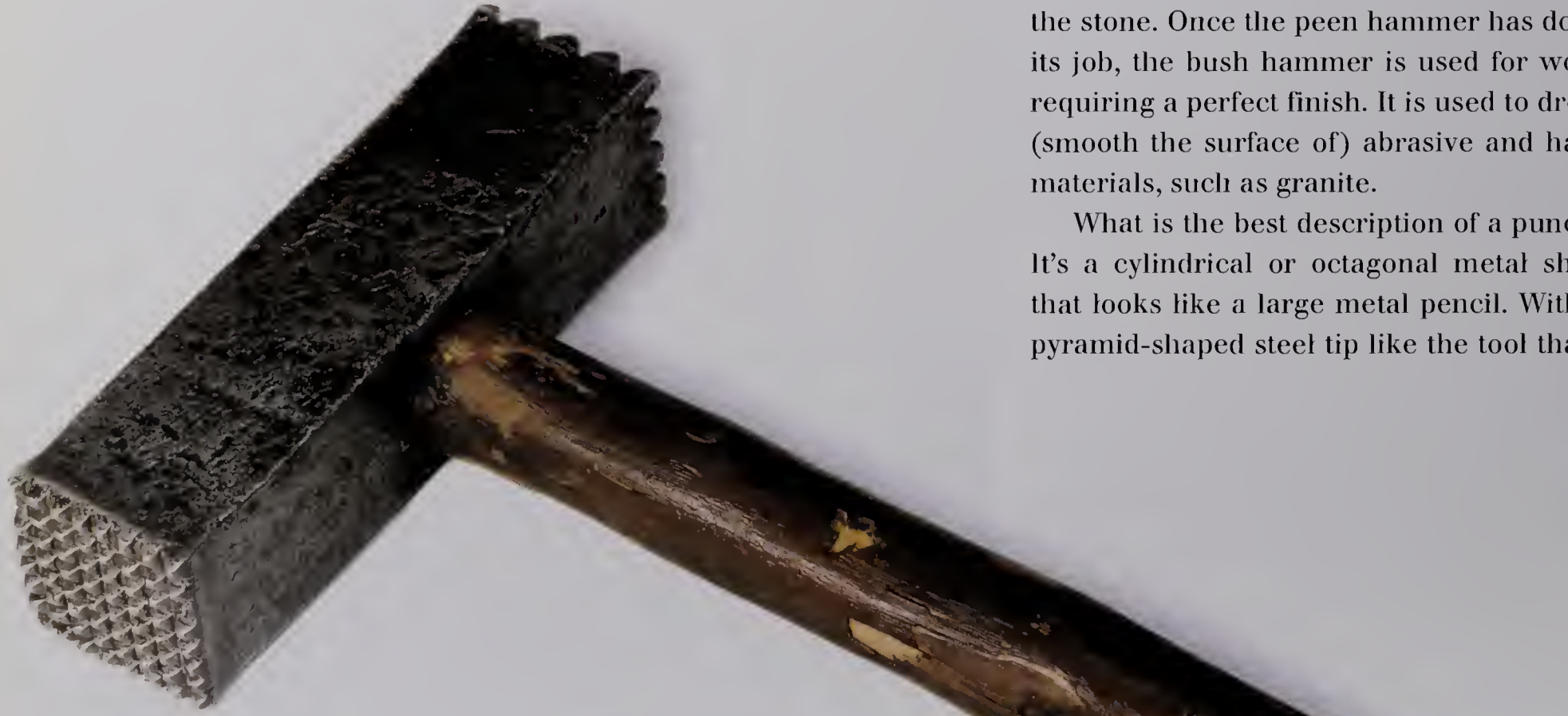
The marteline (whose head measures about ¾ of an inch by ¾ of an inch) is a small, narrow bush hammer (with either four or nine teeth), while the talot, another type of bush hammer, whose head surface can vary, has between four and sixteen teeth.

The marteline has been used, mainly by sculptors, since the seventeenth century for rough-hewing. Later, quarrymen and stonecutters adopted it. On-site, it is used to clean stone; its frontal attack on the surface requires no special technique. The shape of the bush hammer and its mark are alive and well today, but the power to operate the tool no longer comes from the human arm. The bush hammer's diamond-shaped points are now mounted on a jackhammer.

The patent hammer, or patent ax, is one tool that combines several others; each side of the handle contains from five to fifteen steel blades riveted together. It is actually a number of peen hammers placed in parallel, or rather a bush hammer that leaves parallel marks instead of crosshatching on the stone. Once the peen hammer has done its job, the bush hammer is used for work requiring a perfect finish. It is used to dress (smooth the surface of) abrasive and hard materials, such as granite.

What is the best description of a punch? It's a cylindrical or octagonal metal shaft that looks like a large metal pencil. With a pyramid-shaped steel tip like the tool that's

Opposite: **The left hand holds the stationary tool, and the right hand strikes it.**



The bush hammer is used to give a grainy appearance to a saw-cut surface.

called a pick (in fact, half of it—the part that contacts the stone—is a pick), the chisel, which is about five inches long, has a conical head if it is going to be struck by a metal mallet or a rounded head if the worker will use a wooden mallet. Sooner or later, metal against metal produces work hardening: once hardened and compressed to a certain point, the top of a tool can send tiny lethal metal fragments flying toward the artisan's face and hands. Periodically, therefore, the head of the punch has to be ground to be brought back to its original shape, which makes it gradually grow shorter. You can tell an old punch by the length of its shaft.

The punch is less powerful than the stonecutter's pick, but it has the same function, though it works in a finer, more precise, and more controllable manner. It is used to square and rough-hew hard stones before they are sculpted or decorated with molding.

The punch is also called a drill (like the quarryman's tool, a long shaft with a cutting bit on the end) or a point (like the stonecutter's pick, the similarity being clear).

Progress has almost turned this tool into a thing of the past. You can still find drills that look like the old ones, but their tips, which consist of a piece that is an extension of the metal shaft, are made of a material our ancestors would have considered the product of an alchemist's kitchen—tungsten carbide.

The flat chisel resembles the punch, with two differences—the part contacting the material is flat, widened (the edge has a slight bevel instead of being sharpened; it can be curved), and its head, which is struck by an iron or steel-headed mallet, is hardened and beveled to withstand crushing. The flat chisel is the double of the mallet. They are complementary to one another and the first is used to refine the other's work.

The flat chisel is also struck by a wooden- or metal-headed mallet. Soft-stone chisels include tang chisels, in which the root of the blade is inserted in the wood of the handle with a metal ring holding the joint, and socket chisels, in which the blade is extended by a kind of slit sheathed in the handle. Chisels used to work hard stone are made entirely of metal. A chisel with a convex head is struck with a mallet, while a metal-headed mallet is used with a truncated-head chisel.

Chisels can be used to rough-hew or dress stone—detail work—once the tools mentioned above have done their job.

The narrow-toothed chisel is a very fine chisel, and the wide-toothed chisel is a rather large all-metal tool with an edge that can measure up to six inches.

Whether it is steel-tipped, whether its handle is attached by the tang or socket (depending on whether the artisan strikes a metal- or wooden-headed mallet), and whether its edge is straight or curved, the toothed chisel is derived from the dog-tooth hammer and the toothed ax. Its field of activity is more restricted, and the job it has to do is more precise. In short, it allows the artisan to work deftly, to move toward the final finish, but also to work stone parts otherwise inaccessible or too fragile to withstand the force applied by striking tools.

Opposite: **The leg of one of Michelangelo's *Slaves* emerges from the marble block, surrounded by violent or methodical traces of the artist's tools. Musée du Louvre, Paris.**

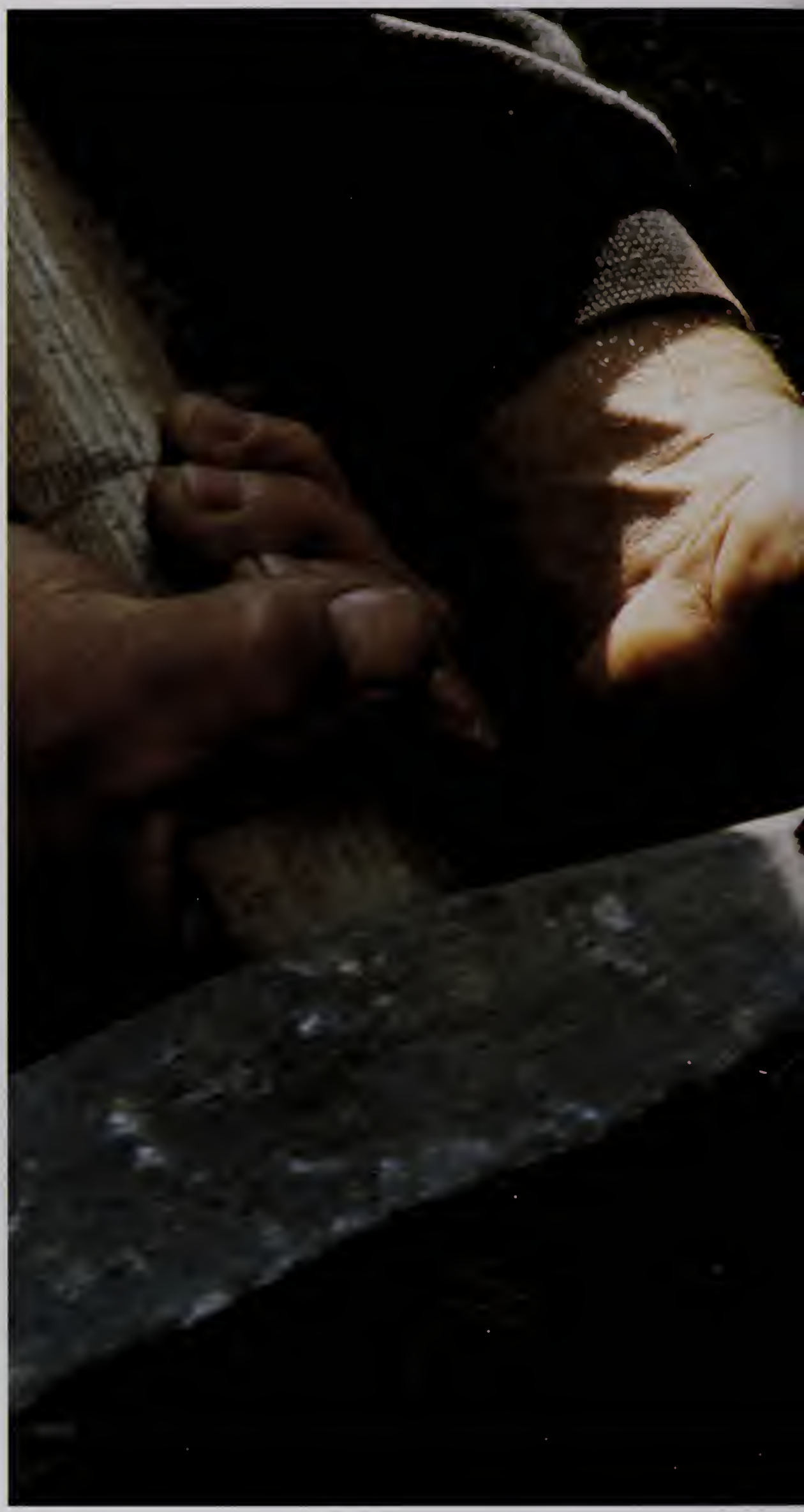
In fact, the sequence of tools used in stoneworking shows how arbitrary the separation is between professions. Each overlaps into areas belonging to the other. The quarryman joins hands with the stonemason, who in turn sometimes works as a sculptor.

The bushing chisel is a reproduction of the bush hammer. It has approximately the same number of diamond-shaped teeth of approximately the same size, arranged in a square, rectangle, or circle. The cylindrical or polygonal shaft ends in a beveled head or a round surface, depending, as do all tools of the same family, on whether the artisan wants to use a metal- or wooden-headed mallet.

The gouge is a rounded chisel. The stonecutter or sculptor may own a series of gouges, from a broad blade and a narrow blade with a slight curve to a more concave blade, depending on the work to be done. Gouges are used to dig molding or concave channels. Struck with short delicate blows, they leave almost no tracks. When their work is done, the next step is polishing.

The mallet. A block of wood at the end of a short handle—that's a mallet. It is used to hit again and again, until it is dug into and marked to the point of being unusable. The mallet is one of those rare tools that are devoured by their work; mallets are used up and disappear. There is no such thing as an old mallet, unless an artisan keeps one out of sentimental attachment to a faithful companion. The rare old specimens are impressive. The thousand blows have dug into them so deeply that you can almost hear the sound.

This tool, wielded with one hand, is made of hardwood such as hornbeam, elder, dogwood, walnut, fruitwood, holm oak, boxwood, ash, and knotty ash. The handle can



be made of a different, softer, wood, such as willow.

Having reviewed the different types of mallets, we can now subdivide them into two categories: those made of a single piece, and those with a separate head and handle.

The first, made of lathed hardwood, is shaped like a bowl, a cone, or a cylinder. A variation of the cylindrical mallet has four rectangular sides. Except for the scored or gridded surface, the shape inevitably evokes the Polynesian wooden tool called a tapa beetle. The resemblance comes from the fact that they are used similarly—people coming together across space in defiance of time. We dream about having the two artisans meet and exchange tools with each other.

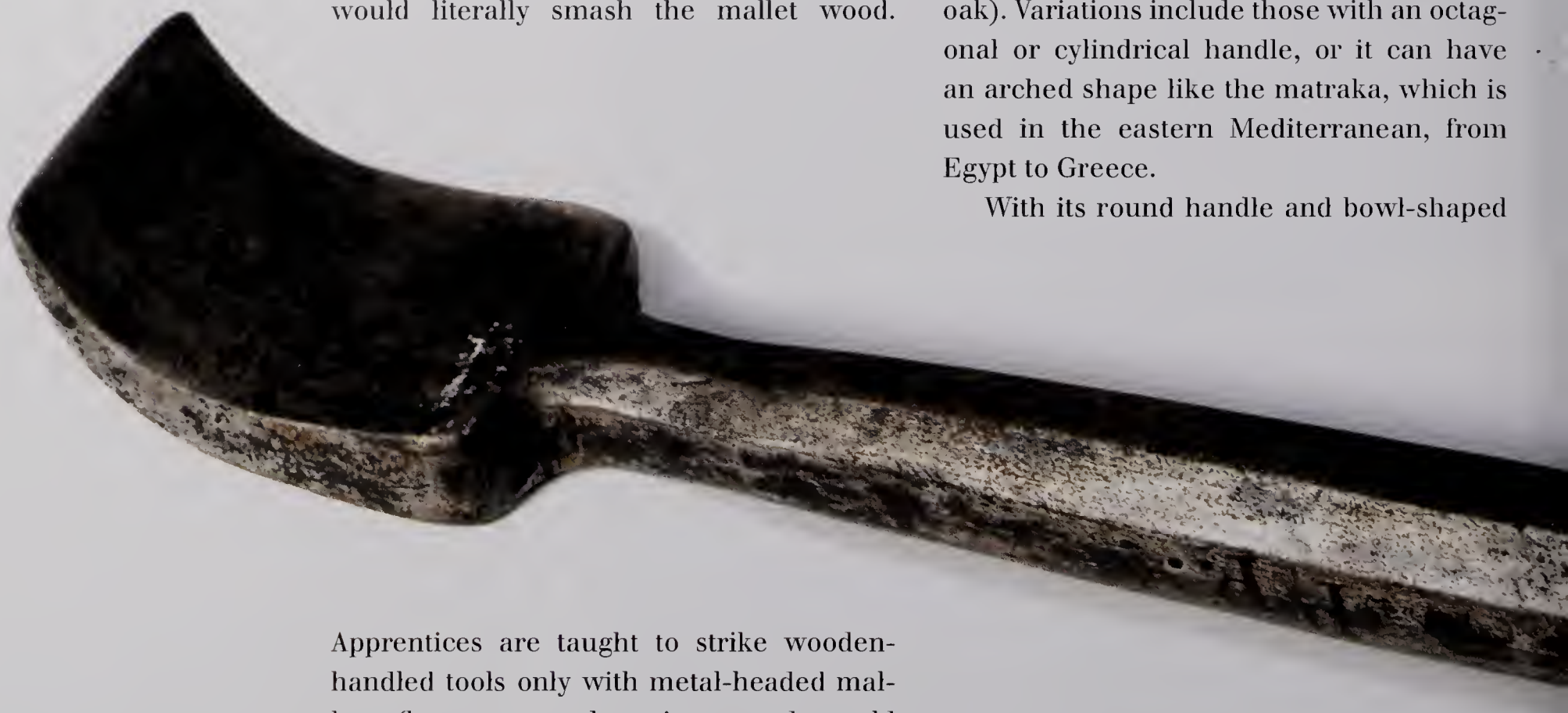
The second type of mallet has a wide variety of heads. They come in shapes ranging from a simple rectangular piece of wood with the corners trimmed to resemble a trapezoid, to a semicircle, wonderfully evoking the striker's gesture and the perpetual back-and-forth motion of the wrist wielding the tool. When one of the mallet-head faces becomes too dented, the artisan changes to another. After a mallet has been recut a few times and the reserve of wood has worn out, the tool ends up on the fire

A delicate moment:

gently starting a job.

with the shavings. Like country people, artisans waste nothing.

To clarify, the mallet is used to hit all nail- or chisel-shaped tools that have a large, round, mushroom-shaped head. Hitting iron tools with truncated heads—which are destined for the metal-headed mallet's action—would literally smash the mallet wood.



Apprentices are taught to strike wooden-handled tools only with metal-headed mallets (because wood against wood would be too soft), while everyday practice admits many exceptions to the rule. When the work requires skill rather than strength, finger technique and touch count more than the composition of the tool being used. In any case, anyone who carelessly strikes a tool's handle with a sledgehammer will feel the handle split immediately. People who have worked with their own hands will have felt the force of this unwritten law concerning the confrontation of materials as a function of the forces at work.

We find inverted bowl-shaped wooden mallets identical to our own in four-thousand-year-old-paintings from ancient Egypt depicting artisans at work. Several precious—and moving—specimens have come down to us, complete with blow marks.

The head of a metal-headed mallet has less volume and, consequently, less weight, and so it has a substantially shorter wooden handle. It is required to perform the same work as its wooden cousin so it is no surprise that they share a number of types. The simplest tool in this family is shaped like a steel rectilinear block whose eye is attached to a hardwood oval handle (ash, dogwood, oak). Variations include those with an octagonal or cylindrical handle, or it can have an arched shape like the matraka, which is used in the eastern Mediterranean, from Egypt to Greece.

With its round handle and bowl-shaped steel head, the Portuguese mallet is well suited to working a point. The worker rotates the handle to distribute the ding marks around the circumference of the head. Over time, rectangular soft-iron metal-headed mallets become worn and unusable and end up in the forge to be repaired.

Finally, peening hammers have an elemental fascination, since they are made of metal only. In some sense they are the metal equivalents of the Polynesian wooden tapa beetle. The peening hammer has a cylindrical head and has long been in use in Belgium, where it is used in particular to cut cobblestones. The carver's tapette is an elongated rectangular shape with a cylindrical handle. It is used for fine etching in sculpture and engraving. The same applies

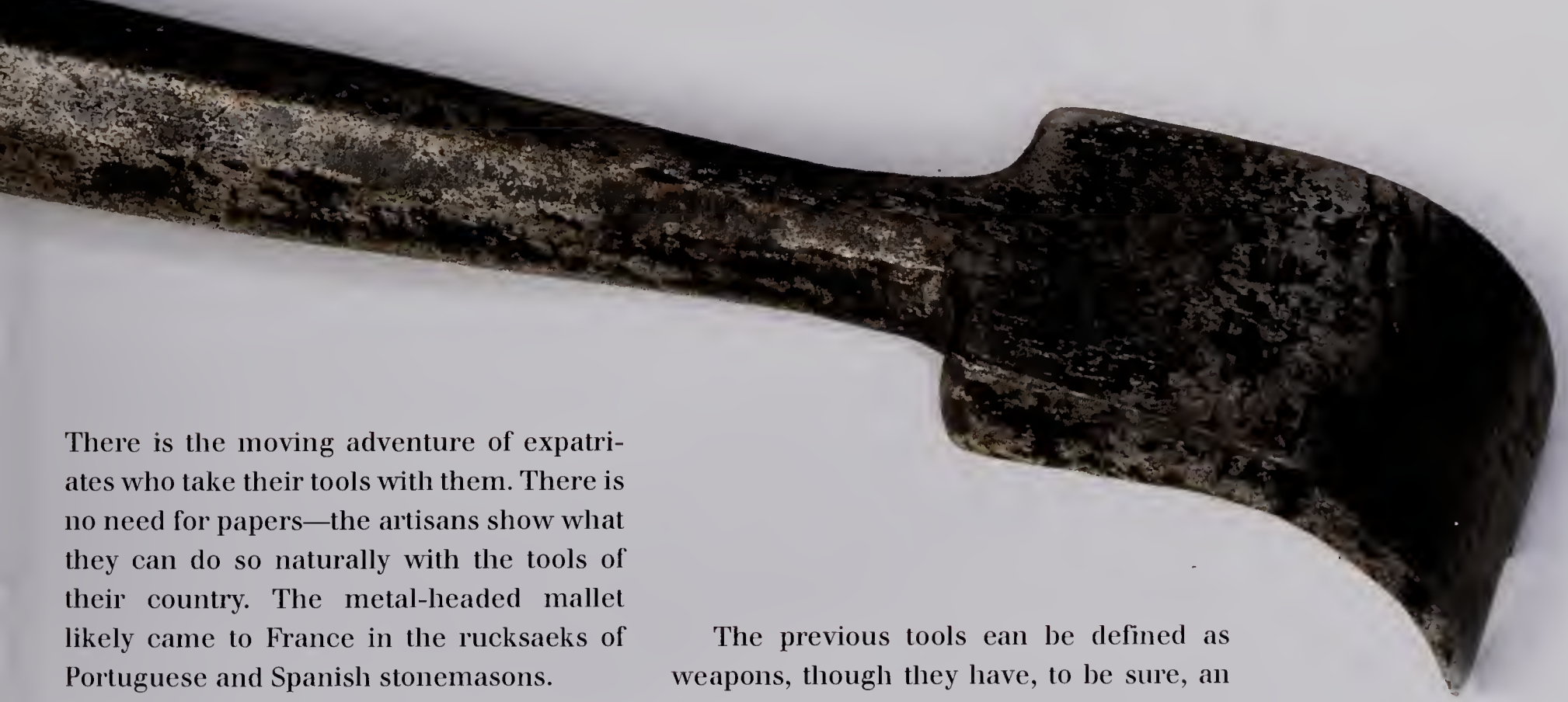
to the two-headed tapette, a small tool used in delieate work, its eight-sided faee giving the user, as it were, a reserve. It is very eommonly used in Italy.

Striking tools are a matter of mutual resistanee. There is no doubt that steel will glance off steel, that the metal-headed mallet will mash a wooden chisel, and that when wood hits wood the outeome is uncertain. Tempered-steel tools, on the other hand, push toward the desired surfaee (the one hidden in the stone) blow by small blow, by striking tools with wood or soft iron heads.

How many tools have migrated from one country to another over the course of time? There is the moving adventure of expatriates who take their tools with them. There is no need for papers—the artisans show what they can do so naturally with the tools of their country. The metal-headed mallet likely came to France in the rucksaeks of Portuguese and Spanish stonemasons.

Why not imagine that laborers and artisans travel, and their tools travel with them? And why not imagine that, in a short span of time, a tool eould go from Samarkand to Istanbul or from Lisbon to Rio de Janeiro? Take a tool to the village blacksmith, and it can be easily reprodueed. Some tools are part of the landseape, and you'll find one in every home, on every farm. It's a kind of emblem. I have seen old Afriean or South American immigrants in Franee use their maehetes and long-handled seythes. The vegetation eertainly isn't the same, nor is what it's used for, but the gesture had been learned, appreeiated, kept, inseribed in memory. And the transplant definitely worked. This is how in a Scottish or Sieilian village you can see a worker using a seythe or a hoe whose model is on exhibit at the regional ethnography museum. Didn't belt buekles, jewels, and harness ornaments cross deserts to inspire the sculptures in Romanesque and Gothie ehapels?

With the seraper, the student of stonemason's tools leaves the domain of pereussion, the world of tools that strike or are struck, to find the tools that do not hit stone but grate it. They push rather than strike.



The previous tools ean be defined as weapons, though they have, to be sure, an inereasingly limited, even softer attaek. We eould define the tools as the untiring ehampions of patienee, speeialists in wear and tear. With the following tools, we have new gestures for the same material, stone.

A seraper: two stoneeutter's chisel edges of varying width at the end of a flat blade attaehed to a trapezoidal shaft. Pushed, the tool eliminates the slight unevenness left

Worked by pulling it toward you, the scoop makes it possible to scrape and smooth a soft stone surface.

The rasp can used to clean blackened buildings in large cities.

by the other cutting instruments. When workers pull a blade toward their bodies, they make sure to rest it lightly on the stone to keep the tool sharp.

The scoop is also a tool with two ends. It consists of an octagonal metal shaft that is enlarged in the middle to make it easier to grasp, and a curved edge on each end, giving the tool an S shape. The most classical scoop has one toothed end and one straight one. There are a number of variations of this tool; one can find wood-handled scoops with curved blades, and scoops with different shapes of teeth (triangular, trapezoidal, and so on). After the other tools have gone over a surface, one can scrape and smooth it with this tool, using a lighter action than the scraper. It is also used by sculptors.

The rasp is a steel shaft with a handle and a large number of teeth, the number and size of which depend on the tool's use. There are many variations on this basic model. The rasp's cross-section can be semicircular, round, square, pointed, or shaped like a sage leaf.

The sculptor's rasp, a small tool about eight inches in length, without a handle, has a different-shape and -size rasp on either end. One is flat and the other is pointed; one is shaped like a rat's tail, and the other like a sage leaf. It is used to provide the finishing touches.

The rasp is a particularly characteristic stoneworker's tool. It is the stone equivalent of a plane, since it smooths by removing a layer of material. The plane produces wood shavings, while the rasp leaves behind stone dust. It grates and planes.

The tool has three parts: a grip cut lengthwise in a board of tough wood; steel blades, which are usually serrated; and a rectangular wooden sole, into which the blades are inserted.

As with other stonemason's tools, if the principle is simple, the variations are many—the size of the tool, the number of blades, their placement, the shape of their edges, and so on. As a result, a worker's toolbox can easily contain a dozen rasps. The rasp had its hour of glory during the great battle to restore the monuments of Paris. This tool was hoisted at the end of a long cord along the facades; it could be heard grating in the scaffolding. These days, it is frequently replaced by a sandblaster using compressed air or water. Either way, in addition to removing calcine (the layer that protects soft stone), the rasp eats away up to a tenth of an inch of stone and so has been strictly banned from use on historic monuments.

The stonemason's saw is called a sciotte. The serrated steel blade, in the shape of a trapezoid, is attached on one end to a hardwood frame with two oval openings for the workers' hands. Like the other saws in its family, its teeth—equilateral triangles—are alternately pointed left and right to create a

path for the blade, that is, the path it cuts through the stone.

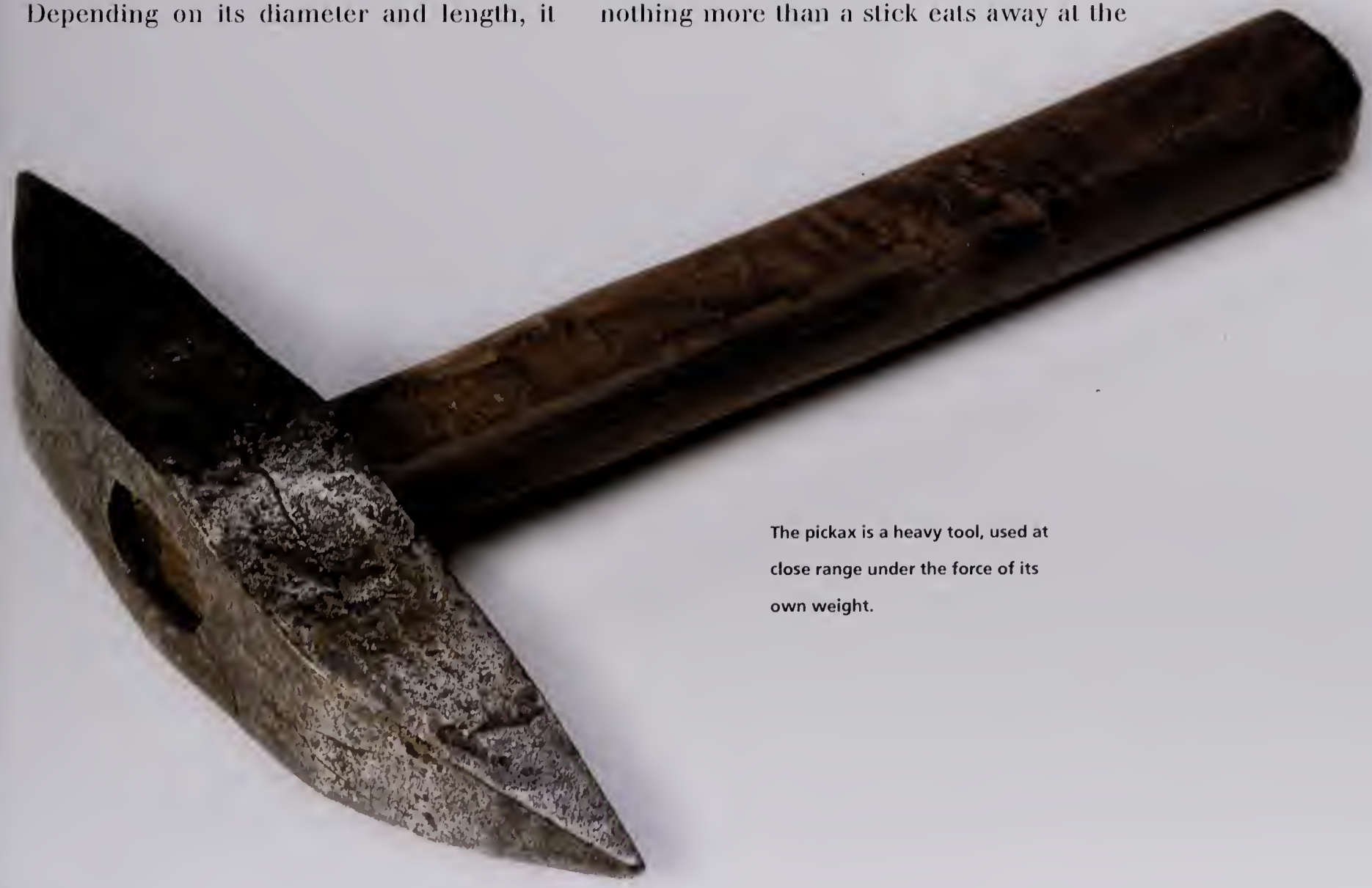
The sciotte is used exclusively for cutting soft stone. Its counterpart for hard stone has a rectangular steel blade, without teeth or a sharp edge, with about twenty small round holes. The reason for this is that it is not a usual saw. It is used with an abrasive, a hard-stone powder—silicone sand, emery, or quartz powder—mixed with water to keep it from heating up. The holes hold the abrasive grains in place so that they can do their job.

The bow saw, as the name indicates, consists of a copper or iron wire held by a wood or metal bow. It too is used with an abrasive.

As for the turning saw, the tool is incorrectly named because it does not have the teeth of a saw, and it is not used with a back-and-forth action. Rather, it is a metal cylinder rolled on and then in the stone to scoop out a circle. More precisely, this tool, which uses an abrasive, is a cylindrical drill. Depending on its diameter and length, it can be worked between the palms of the hand using a bow or a rope. Created during the nineteenth century, it has been used mainly to work marble into such small household furnishings as clocks. It has progressed with history, going from hydraulic power to steam, fossil fuels, and electricity.

The use of powdered hard stone—sand—to remove and then dig stone links these last tools together into a unique group. By examining them we are rightly interested in revealing a lineage beginning with the hypothetical tools of this kind used in antiquity—in particular, Egypt—to arrive at the drill bits (equipped with tungsten carbide or diamond concretion pellets) used today by the mining industry or in geological research.

Far from coming out of nowhere, these modern tools—and, certainly those of the future—are linked just as definitely to the equipment of the ancient Egyptian stonecutters who one day discovered, perhaps by accident, that sand rubbed on a stone with nothing more than a stick eats away at the



The pickax is a heavy tool, used at close range under the force of its own weight.

stone's surface. From a stick to a strap, from leather to metal, once again, the modifications of a technique have been passed down to us like a baton in a relay race. In the twentieth century, the old tools have evolved into formidable equipment, and we have forgotten that the know-how exists because it was passed from hand to hand. Perhaps, just as we are on the verge of forgetting a technique, a child might say, "I remember the old people used sand." She could try it, and the thread would be whole again.

The tool used to make a hole in stone is called a drill. Unlike those tools that strike, are struck, or are worked with a back-and-forth motion, the drill works by rotation. Structurally, it consists of three parts: the bit, a cylindrical section that can be called the bit holder, and a driving device.

Today's drills are made of steel. In the past they were produced from bronze or copper. The shape of the head (the end of the drill, which is in contact with the stone) can vary greatly: flat head, spear (or lancet)

The auger bit, the drill point that pierces stone.

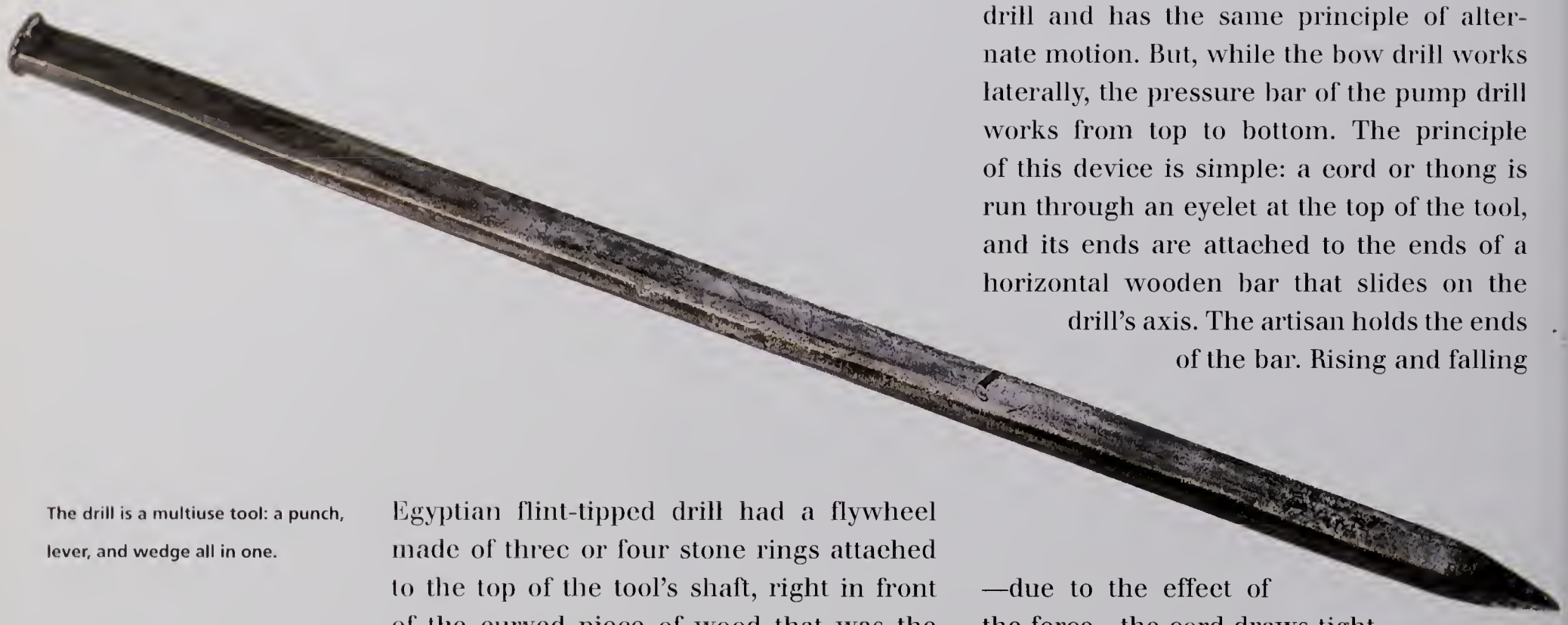
Walking through a quarry is an unforgettable experience. From one end to the other, it tells the history of stone.

point, flat chisel, curved chisel, cutting spoon, screw, serrated cone, and so on. The ancient Egyptians used a drill consisting of a hardwood shaft split at the end to hold a small crescent-shaped cut-flint blade. Of course, the system for attaching drills (which are, in general, between 16 and 20 inches long) enables the user to remove them for sharpening or changing. The simplest drills consist only of a metal tip fixed to a cylindrical wooden handle by a ferrule.

Stonemasons have shown their remarkable ingenuity over time and space in inventing and then perfecting the driving device. Little by little, the drill evolved, profiting from new discoveries.

The hand drill is nothing more than a nail with a wooden handle, whose bit is distorted to form wings that screw into the stone to enlarge the hole dug by the tip. A tool requiring patience and slow and constant motion, the drill leaves behind powdered stone; it is the opposite of a struck tool or a weapon, which produces chips. Imagining how it is used conjures up a strong feeling in each of us. Since it requires two parallel hands that turn a vertical cylinder of wood back and forth, doesn't the drill reproduce the gesture of those who first made fire—genuine magicians, if you come to think of it—turning a blackened stick on a small board dug with charred holes?

How to improve this tool? How to speed it up? How to make it work more efficiently? It's simple, say those who see the refined tool work. By rotating a drill in your hands, first clockwise, and then counterclockwise, the tool cannot use all of the force applied to it. But placing a cylindrical mass on the drill handle creates a flywheel effect. In other words, this wheel releases all of the energy given it. It works longer than the stonecutter's hands; it takes full advantage of the force applied to it. Depending on the size of the job, the size of the drill, and the hardness of the stone, this wheel can be a round metal sheet enclosed by a thicker ring, or quite simply a small stone. The ancient



The drill is a multiuse tool: a punch, lever, and wedge all in one.

Egyptian flint-tipped drill had a flywheel made of three or four stone rings attached to the top of the tool's shaft, right in front of the curved piece of wood that was the drill crank.

But these repetitive motions were too short for an awkward tool. That is, the wood driller had to operate the tool, keep it in the right position ("aim" it, as we would say for a firearm), and set it in motion. The next improvement was the invention of the thong drill, with or without a heavy wheel acting as a steering wheel. With it, artisans have to work in pairs. One person holds the shaft, operates the tool, and pushes it in the direction of the stone to be drilled. The assistant pulls the end of a thong or a cord wrapped two or three times around the wood cylinder attached to the drill. That way the drill rotates in one direction and then the other, which to a certain extent makes it easier to penetrate the stone and to prevent it from clogging up with stone dust.

For work requiring less force and more precision, the drill and its drive mechanism can be placed between one person's two hands. This shorter (and therefore more stable) tool is called the bow drill and is powered by the force exerted on a cord around its axis. This cord is often gut, and its ends are attached to the two ends of a wood or metal shaft that the worker moves back and forth using a small grip.

The pump drill derives from the bow drill and has the same principle of alternate motion. But, while the bow drill works laterally, the pressure bar of the pump drill works from top to bottom. The principle of this device is simple: a cord or thong is run through an eyelet at the top of the tool, and its ends are attached to the ends of a horizontal wooden bar that slides on the drill's axis. The artisan holds the ends of the bar. Rising and falling —due to the effect of the force—the cord draws tight on one side and then the other, depending on whether the bar is going up or down. A heavy cylindrical mass attached to the base of the tool above the drill bit ensures that the effect of the rotation will be powerful.

The bit brace, identical to the one used by cabinetmakers, though heavier, is a hand drill with an axis curved to hold a crank. The base has a handle that is used to guide the tool, the crank turns the drill, and the front knob can support the whole body if that much force is needed.

Sharing the design of certain deluxe children's tops, the spiral drill creates continuous motion of the auger bit by pushing a slider.

Finally—the most advanced drill that uses no power source beyond the human —there is the hand drill. A side handle enables the user to hold the tool steady, while a turning handle is parallel to the drill, with a butt as pushing point. The gears in the body increase the action of the handle.

What are the uses of these tools that drill stone? In sculpture and stonecutting, the holes they dig can prepare cavities in a slab, draw a kind of dotted line to detach a piece, and receive metal pins that will attach two parts of a statue. A slow, precise, prudent

tool, the drill, used on the surface one step at a time, allows a sculptor to move toward the desired form by means of actions consisting of a series of chisel blows, which are then refined with the rasp and polishing. Seen from up close, statues like Michelangelo's *Slaves* in the Louvre show drill marks, isolated or in strings. This is because the two famous statues were left incomplete by the Florentine master.

Drill holes can be used to mark marble finishing, with their depth indicating the thickness of the material to be removed. Medieval master builders also used them to set off the contours of a person or the design of decorative foliage on a capital.

A fine example of this procedure is contained in the album of the thirteenth-century French architect Villard de Honnecourt. In it, the author sketched out various basic images—people, animals, plants—on top of which he drew simple geometric figures. Using a drill, all one has to do is mark various points—the intersection of the lines, the centers of the circles, the tops of the triangles—on the stone to be sculpted to insure that a motif will be traced accurately.

Finally, the drill line can be used as an effect in itself. It provides accents of shadow in the clear structure of a sculpture. The capitals of many Roman, Byzantine, Romanesque, and other columns are examples of this technique.

The hook is a chisel with a blade that can be a variety of shapes (rat tail, crescent, oblique tip, and so on), though the edge has a spur near the handle. This recess enables the artisan to precisely and faithfully follow a wooden template and reproduce a column, molding, baluster, or a decorative or architectural element on a block of stone attached to a lathe.

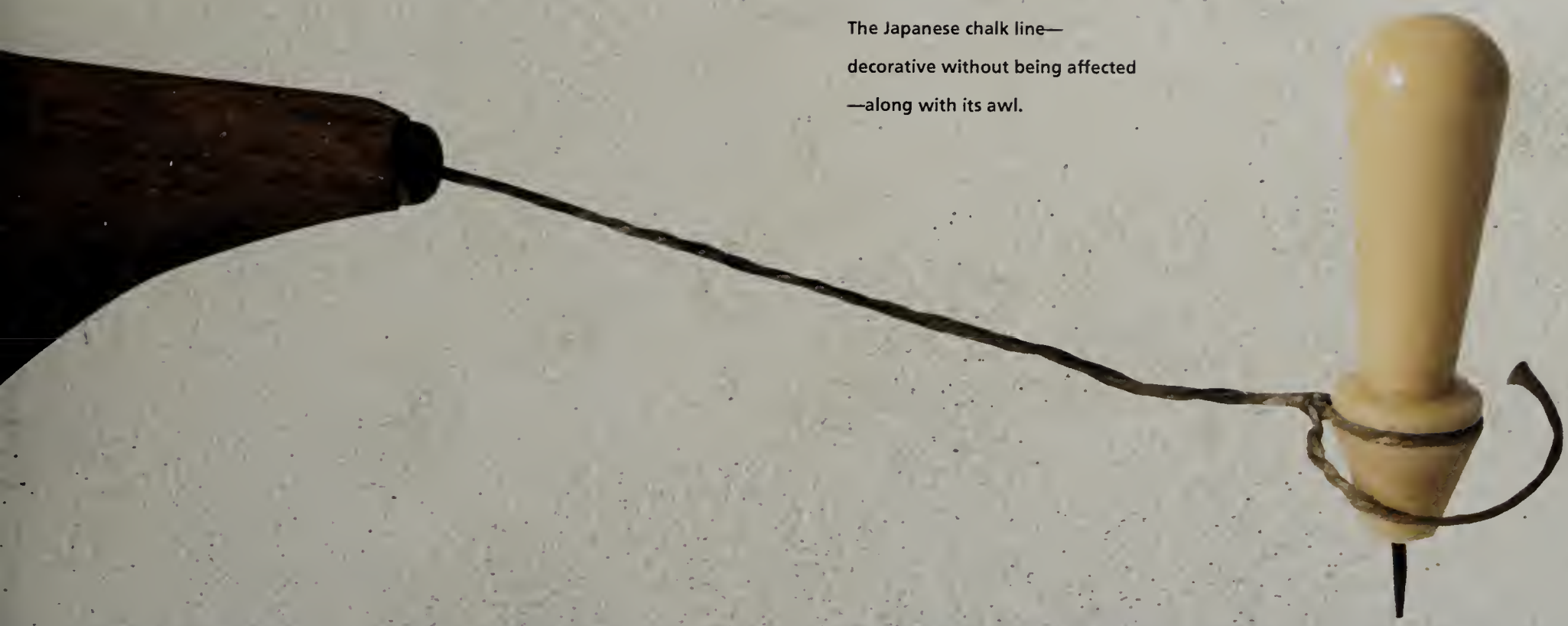
The principle of this Moroccan pump drill has been used for children's tops. The weight of the rotating stone makes it highly efficient.

Chalk Line

JAPAN

In many countries this instrument is the constant companion of masons, painters, and plasterers. It is used to draw a colored horizontal line on a surface, with the plumb bob giving the vertical. The principle is simple: a string coated with colored powder or ink is stretched between two points. Then it is pulled away from the wall and snapped sharply so it leaves a straight line. This is how to mark a line or a boundary.

There are simpler tools used for the same job, including a length of string and a bag of red powder. A version commonly sold consists of a small oval plastic box with a crank.



The Japanese chalk line—
decorative without being affected
—along with its awl.

As is often the case, the Japanese version of this tool is extremely refined. Traditional chalk lines consist of a rectangular box with a bob, a crank, a set point at the end of the line, and a small container for a wad of cloth soaked in printer's ink, which the cord runs across.

The specimen above, which has been available for a few years in Japanese art supply stores, has great esthetic appeal and understanding of the object's dynamics: the part that holds the pulley axis complements its shape; and the heart-shaped front and the turned-up stem anticipate the gesture of pulling the string. It is symbolic of itself.

The Miner

This tool is shaped like the beak of a bird of prey at the end of a long handle. It is used to dig, to break up the ground. Pointed on one edge, sharp on the other, it is what we call a pick.

In this ground we first find the flint with which to make blades, tools, and weapons. Then, thanks to the pick, we can extract building stone and then ore. The pick is the miner's tool. Without it, metallurgy would not have developed. In fact, metal was first discovered on the earth's surface, and when the open-pit mine was exhausted, miners had to dig, to sink into the bowels of the earth, to find these strange minerals used to make bronze for new tools.

A corner had been turned. Now another mineral was needed, and iron was found. Using the pick, miners went further, deeper. And the metalworkers invented a number of ways to work the new metal—amazingly malleable once it left the forge, but as hard as diamonds once it had been tempered.

Opposite: **Miners in Carmaux, France, along with their helmets and lamps.**

A diamond mine in Alexander Bay, South Africa.

TOOLS AND RITUAL

In *The Elective Affinities*, Goethe describes the placing of a cornerstone: "Below, the mason held his trowel out to Charlotte, who used it to throw lime on the stone. He invited a number of people to do the same, then the stone was set; after which the hammer was presented to Charlotte and the others to expressly consecrate, by three taps, the union of the stone with the soil."

Earlier in the novel, Goethe had explained that the stone could have been set as it was, its weight being sufficient to seat it properly, and that though people have a greater cohesion among themselves since laws bind them, one couldn't get by here without lime and cement. The stones whose shapes correspond to each other are better joined by linking forces.

The eloquent master mason directed by Goethe used his tools to conduct ceremonial gestures. More recently, artisans used finely worked and precious tools only once, ceremonially. The Victor Emanuel II monument and museum in Rome preserves trowels used on the cornerstone; and a hammer used to remove the pin for launching ships is on display at the Maritime Museum in Lisbon. Surely, other specimens lie peacefully slumbering in the display cases of private collections.

Masons

So that visitors wouldn't be thrown by the term, the inhabitants of this village in southern Portugal would always explain that the mason was the one who builds walls. That contains a simple absolute truth. Early in the morning, you walk by a tiny workshop: tools, instruments, mortar, rubble-stone border are set out along two strings indicating the placement of the foundation of a wall. By midday, a structure is rising from the ground, like the spinal column of some huge serpent. We watch the men at work. Incredible! You would think that piling layers of stones on top of each other with mortar, that mineral glue in which they are embedded, would be a mechanical task, but masons are actually careful examiners of stones. They weigh each one, turn it around, feel its place in the wall, abut it with the other stones, and welcome the ones that will support it. The trick is to predict the flush fittings. A good wall is like a puzzle, since the diagonals, the verti-

A work crew. Not too long ago, an entire village would take part in construction work.

Construction of a church in Haukanga, Mali. A country ladder is in the foreground.

cals, the horizontals, and the forces resulting from the weights and shapes complement and compensate for each other. A blow with the mason's hammer here and there breaks off a piece to help the stone better keep its place in the heavy and—if you think about it—daring mosaic. The level, the taut cord, and the plumb bob keep track of the artisan's progress. The trowel, which is never put down, is used to lift the mortar, pack it down before setting the stone, remove the excess (because nothing may be wasted), and, finally, using its tip or side, smooth the joints between the stones and fill in the cracks. Soon, perched on a scaffold, the mason will continue to turn each stone, to examine its six sides before giving it the place that awaits it in the wall.

Of course, the tool's shape has to meet the requirements of being easy to handle,

TINTORETTO

The Crucifixion. 1564–67. Scuola di San Rocco, Venice.

The painting is over sixteen feet high and thirty-nine feet wide. On horse and on foot, characters abound, contemplating, meditating, lamenting, or bustling about the execution site. In the exact center, a cross bearing Christ is already set up. On the left, men are pulling the ropes by which one of the thieves is lashed to another cross. It will soon be in its place. On the right, a worker armed with a spade is digging the hole where a third cross will be erected.

The atmosphere is heavy. The authorities want to get things over with, for they are in a hurry. The man with the spade, this colossus without a face, is not looking at anyone; he is concentrating entirely on his work. Near his feet are long wood wedges that will be driven to support the base of the large beam. His right foot, which bears his entire weight, is solidly planted on the ground. His bare calf muscle is taut. The pleats of his shirt, like so many lines of muscular force, direct our eye toward the belt and the bright spot emphasizing his powerful hold on the handle of the tool. To lend the figure even more movement, his hand is jutting out far behind his back. The grip of his hand echoes the calf, and extends it along the ascent up to his raised elbow. Then there is the dizzying descent by his twisted back to the other shoulder, thrust forward. His left elbow disappears behind his raised thigh to apply more weight to the side of the tool. We presume that the man's gaze is fixed on the progress of his work. His second hand seems to be placed acrobatically near the base of the handle.

Powerfully arched, the worker pushes the tool along its axis. At an acute angle, the lines of force of his muscles converge on the tool digging into the ground. The work he is engaged in is not willless or passionless; we can even detect a certain anger. The worker is using his spade, with all of his body, energy, and weight, intent on his digging.

He is the personification of action and labor, alone in the midst of an alert, gesticulating multitude. In the painter's eyes—and what an observer he is!—this man is the incarnation of the continuity of the life of the humble despite the storms of life and history.

Spade

A Brand of German Beer

Nothing exists by accident, especially in the world of business. Advertising, in all its many forms, has always existed. Roman law tried to channel it, to mitigate its excesses.

Why then the connection between the chilled beverage and the agricultural tool? The choice is due to the fact that the association of ideas is vague and for that reason not liable to be contradicted or rejected.

The spade is used by a real laborer; and beer is an effective thirst quencher. The spade is peaceful and timeless; the beverage, natural. The worker is able to wield the tool thanks to the energy he gets from the beer. Thus, the two are associated before, during, and after the time the spade is actually handled. Man's best friend is his glass of beer.

The tool is square, and its silhouette evokes a calm energy—this is not a beer that will encourage a drinker to overindulge. The metal—smooth and clean—bears a resemblance to the cool surface of the glass into which the beer is poured.

The best trademarks can be the simplest.

Shovel

Who, at one time or another, hasn't come across a worker using a shovel on the side of the road? The tool is universal. Simple to the point of being basic, with its rounded blade and long diagonal handle, it can be used without having to bend over too much. Still, many workers one asks about how the shovel works give an answer that seems to go back to their childhood, from the time of building sandcastles—they say the shovel is used to dig. It, you see, is not meant to dig a hole in the ground, to tear through the earth, but is good for gradually moving an impressively heavy amount of material, whether it's sand, cement, gravel, or mortar.

Using a short shovel, a steam-locomotive engineer can shovel coal into the firebox. The construction worker's shovel is made to insert the mix into the revolving cement-mixer's drum, among other tasks.

With a shovel, you can lift a small amount of material to put it elsewhere, to drop it, or to throw it a little further. It is worth noting that unlike the majority of other tools that really have to struggle against matter (the woodsman's ax, the carpenter's saw, the road worker's pick, the farmer's hoe, the stonecutter's chisel, the cabinetmaker's gouge), all the shovel does is to move a quantity of material that is in powdered form, like sand, or soft to the point of being easily broken down, like potter's clay.

light, and adaptable to the type of material being moved.

Thus, the locomotive engineer's shovel is made of metal like the mason's, but the handle has a transverse grip held by a metal Y, so that the engineer is able to throw as well as push and lift. Its two sides are raised to retain the precious fuel, as in a chute. It has to be solidly made, for the engineer works very quickly.

The shovel used to slide pizzas into the oven is short and made entirely of metal because it gets close to the burning charcoal.

The baker uses a huge shovel with a flexible handle that does not support much weight. It is used to push the wooden board holding the dough along the oven floor.

Finally, short, sturdy wooden shovels help move delicate fruit and vegetables, such as apples or potatoes; such shovels do not run the risk of cutting or digging into the produce.

To avoid breaks along their length, these wooden shovels are cut along the axis of the tree trunk from which they came. There are no diagonal lines between the handle and the cutting section. This means that the worker has to handle these tools in a special way.

The steam locomotive engineer shoveling coal.

The Paver

One knee on the ground, not looking at the pedestrians and vehicles, pavers are at work. They don't require silence to work, for they work in public. Their job is not glamorous like the glass-blower's, the blacksmith's, or the farrier's. However, they do attract the attention of a few curious passersby who suddenly realize that they have no idea how traditional paving is done.

What do the pavers have? A pile of cobblestones, a pile of sand, a can full of water, two iron levers, a paving hammer, and a rammer.

Whether the workers have to make simple adjustments or create subtle geometrical figures or complicated semicircles, they have to think of each stone as a special case, an individual. That strikes the viewer. The pavers hold each stone and examine every side, and sometimes put it back on the pile, for another one will fit better in this precise spot, especially if a chip is taken off with a swift blow of the hammer.

The artist-paver has spread some sand on the flat or slightly curved dirt base. The good cobblestones are in the right position, but they are slightly too high. A few blows of the hammer aren't enough. The worker will have to use something bigger, so while an assistant pours some water that will carry along a thin layer of sand, he holds the paving stone between two levers and rocks it gently so the sand will give way. A blow

Laying paving stone on the streets of Paris, 1908.

Overleaf: **Ramming in Laos.**

with the hammerhead or even the end of the handle says that the stone sits securely in its place, like a small piece in a mosaic.

The posts supporting the snap line have already been set up. At times, the work is so exact and delicate that a veritable spider's web appears above the ground, tracing the pattern to be created.

The work continues: trying, putting in place, adjusting, checking with the eye and the level. Having finished a portion of the work, the worker levels the ground of the next section using the heavy rammer, or beetle—a heavy wood cylinder with two handles used to pack the dirt.

Chipping Hammer

Breaking stones, a job reminiscent of mythological punishments. India.

Breaking stones—stoop labor—has become shorthand for the most laborious activities, the worst of professions. It seems to be the most meaningless labor of all. Reducing a stone to a pile of smaller stones—truly a never-ending job—seems like a punishment from mythology or Dante's *Inferno*. No sooner have you reduced the old pile into a mound of pebbles than a new cartload of stones comes to take its place. It's the worst-paid work, offering nothing more than the opportunity to inhale stone dust, burn up your throat and lungs, or collapse from sunstroke despite the small cloth awning that is supposed to be sheltering you. It's chain-gang work.

What are these renowned, cursed, endless stones good for? To build the stable foundation for roads and to pile into a compact and flexible bed under railroad ties that will support the weight of a train weighing hundreds of tons without being damaged.

The work consists of smashing the large stones on the left-hand pile and—to add variety—occasionally taking the smaller ones and throwing them to the right. And then starting all over again.

The toil and the aftereffect of the shock on the arms can be reduced by choosing a hammer with a cylindrical and relatively long—and therefore flexible—handle. Until it breaks, the branch of a bush would do the job nicely. A well-aimed flick of the wrist is enough to break the stone.

The Slater

Sometimes, walking along a street in the city or near a village church, one can hear cries or songs that seem to come from the sky. Roofers are working on the roof of a house or way up in the church belltower. It's an acrobatic profession if ever there was one—the worker hangs above the void on the slippery incline of slate tiles, performing delicate operations that often require both hands to be free when one should be used to hold on.

It is quite obvious that these workers in the sky should be burdened as little as possible; they hate being overloaded—and even worse, seeing their tools slip down and possibly injure a pedestrian.

Since slaters have only a small number of tasks to perform, they have streamlined the number of tools they use and have given them each a number of functions. If the roof is being covered for the first time, two nails to hold each slate are driven in first. Some of the tiles, which are laid in overlapping rows like the scales of a fish, may have to be recut if they are too large. The slater's hammer is designed to be able to strike a copper nail, remove a nail in case it has to come out, and cut the slate with a point. Still, to perform this work one needs a point of support, as there is no workbench up on a roof. The slater's iron handles everything. The artisan places it in the lath (the strip of wood that serves as the groundwork for the slate) and continues to work.

If the job is to redo an old roof, the worker uses a slater's claw, a flat blade with teeth pointed back that is slid between the slate tiles to pull out the old nails. If a repair is needed on the wood furring, the long edge of an ax (which also has a claw, a hammerhead, and a pick) can be employed.

The slater's hammer—as well as boasting a pick ready to dig into the wood and a square flat blade (for cutting slate)—can be equipped with a handle on one end and claw teeth on the other.

These few tools cover and recover a whole roof of slate tiles. Slaters definitely believe in traveling light.

Opposite: **A slater at work.**

Above: **A slater's tool, a combination sword, pick, and hammer.**

The claw, whose flat blade can slide between the tiles.

The Glassblower at Work

Two glassblowers' gestures, separated by several centuries.

Glass existed in Babylon and ancient Egypt two thousand years before Christ. Pliny writes, no doubt passing on an oral tradition, that glass was discovered by accident. Merchants crossing Phoenicia stopped to roast some meat. Not having any firestones, they used pieces of saltpeter (potassium nitrate). The mixture of potassium nitrate and desert sand melted under the heat, cooled, and formed a new material of appealing transparency and brilliance. It was glass. The history of science and technology shows that many discoveries came about as the result of the meeting of a curious observer and an accidental phenomenon.

The composition of the mixture that turns into glass has changed with time. In the Middle Ages, for example, French glassworkers, renowned for their white glass, mixed one part washed sand and two parts beech ashes. To produce colored glass, they added potassium, which they obtained by burning plants such as ferns. Apart from such variations, the basic principle is to mix sand, calcite, and sea salt.

A glassworker's shop is always very spacious. There are a number of reasons for this. First, it houses a furnace in which the pot metal is melted and then worked. Then, the glassblower's tools are large—the iron blowing pipe is over six feet long and less than half an inch in diameter, with a wood handle about a foot long. As glassblowers work in teams (often in threes) and have to change position a number of times while carrying a burning ball at the end of the long iron tube, they have to be able to move about freely. Watching them work, one thinks that they seem to have a sixth sense. Each of them knows where they are and where the other two are going—and this without exchanging a word.

In addition to the furnace, the glassworker's workshop contains a kind of workbench, the chair (two horizontal metal shafts ending in a U where the tube can be placed to turn it without having to support it), and a pit in which the glassblower can balance the tube to draw the pot metal by simple gravity.

Using the tube, preferably heated, the glassblower "spoons" a certain amount of bright-red pot metal from the crucible. Using one hand, the pasty glass is rolled onto a plate called a marble so that it is evenly distributed around the end of the metal tube. The time has come to blow while constantly turning the tube: this is how the vessel, glass, or bottle will have a perfectly even thickness. Meanwhile, the glass begins to harden. So the next step is to expose the glass (now in the shape of a large wrinkled olive) to the furnace flame.

If necessary, the glassblower turns the glass ball in a glass mold—a wood cube hollowed in spherical thirds with a simple metal handle—to produce a round shape.

To make a bottle, the artisan puts the glass (still heated) into an open mold made of thick wood, closes it, and blows so that the glass adheres to the inside of the mold. When the time comes, the bottle can be removed from the mold, and with the help of large glass snips, cut off the tube.

To the amazement of the viewer, this demonstration of sleight of hand can be followed up by additions. A carafe can be decorated with a curled glass thread, for example, if the glassblower, using fine metal glass-drawing tongs, delicately pulls out a fragile glass thread.

If the object being made is a fruit bowl or a stemmed glass, an additional piece must be "glued" to the cup-shaped part. The glassblower's assistant places a small amount of glass on the piece from the end of a solid metal tube—there's nothing to blow here. Still turning the stemmed glass, the artisan uses centrifugal force to widen the base and tongs to perfect its thickness.

The fascination of blown glasses, salad bowls, and carafes comes from their individuality. There is always a bubble here, a slight ovality there, a minor difference in thickness somewhere else. Still, members of a set are supposed to be as uniform as possible—even if only in terms of capacity—and the glass artisan can make sure of this during the process of the work by using a large thickness caliper, an instrument that checks a diameter.

A glassblower in Damas, Syria, 1988.

THE INCOMPETENT GLAZIER

The first person I saw in the street was a glazier whose piercing and discordant cry rose up to me through the heavy and dirty Paris air. . . . "Hey! you down there!" and I called out to him to come upstairs. . . . At last he appeared: with curiosity I examined all his panes and said to him: "What? don't you have any colored glass? pink, red, blue glass, magic panes, windowpanes from paradise? . . . panes that make life look beautiful!"

Charles Baudelaire
***Le Spleen de Paris* (The Spleen of Paris)**

The Glazier's Coming

If a window is broken in the wintertime, eighteenth-century French philosopher Jean-Jacques Rousseau suggested not repairing it too quickly, as having the wind blowing indoors can be a lesson to clumsy children. Nowadays, we call the glazier. Not too many years ago, you could just respond when you heard his cry in the street, "Glazier, glazier!"

He arrives, carrying a wood frame on his back to which panes of various sizes are attached by straps. On his shoulder is a bag containing tools and a lump of putty wrapped in a rag.

The first step is to remove the pieces of glass still in the window frame. Once this is done, the hardened putty in the old frame is scraped out with the flat end—shaped like a cold chisel—of an all-metal hammer.

The diamond cutter and how it is used.

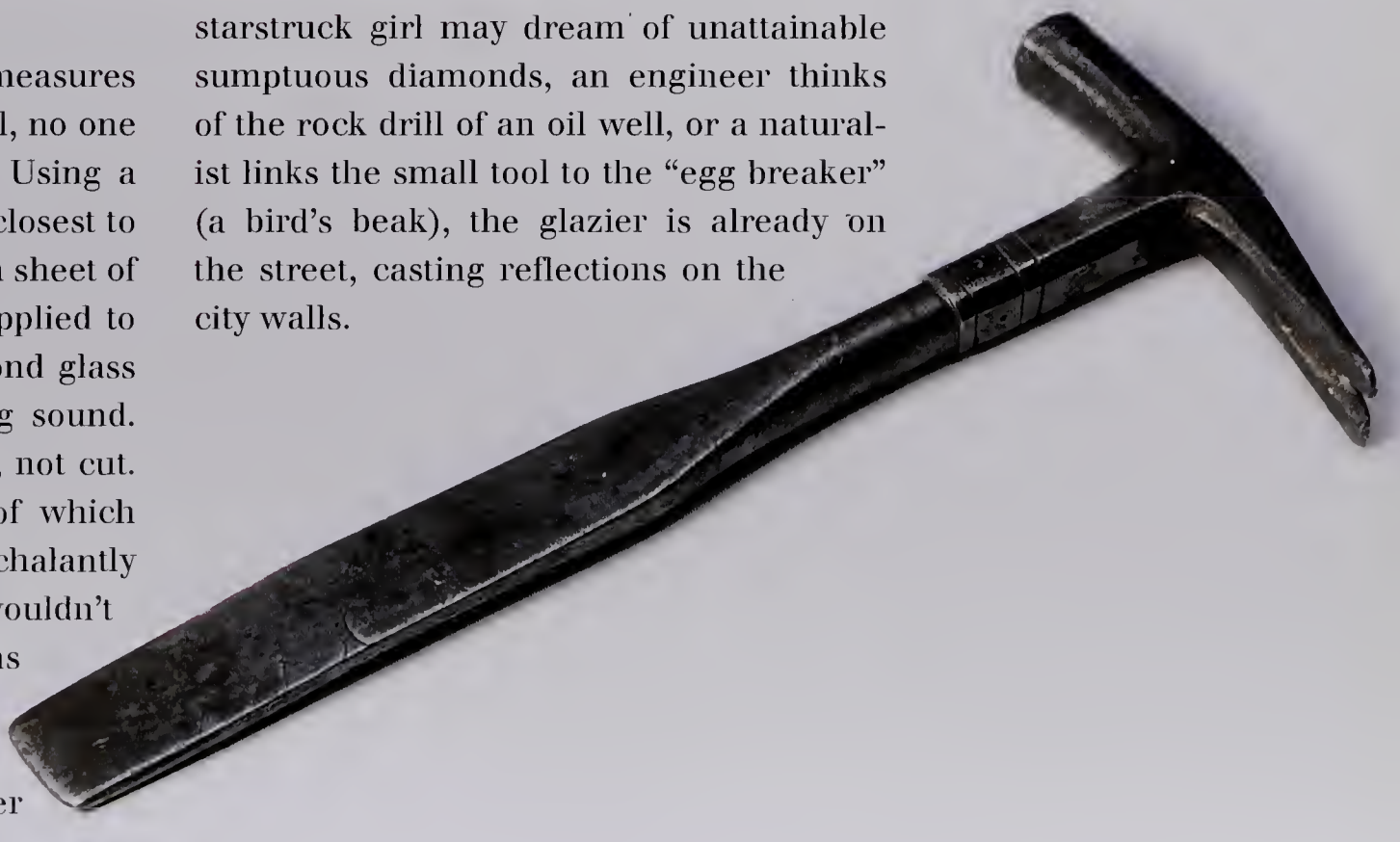
After that, the small headless nails used to keep the glass in place (glass points) are removed from the wood frame. A tiny pair of pliers does the trick; once the nail is in the pliers all you have to do is tip up the tool by its rounded head to get the best leverage.

The frame is clean. The glazier measures the four sides of the frame. After all, no one says that the rectangle is perfect. Using a grease pencil, he draws the shape closest to the contours of the future pane on a sheet of glass. He holds the ruler firmly. Applied to the surface of the glass, the diamond glass cutter makes its typical scratching sound. and the sheet of glass is scratched, not cut. Using a tiny hammer, one side of which holds the diamond, the glazier nonchalantly hits the side opposite the scratch (wouldn't it be great to know how?). It seems that the pane will break into a thousand pieces. . . . No. The line of least resistance won out over the wholeness of the pane. The blow was clean but delicate. That is called dexterity. Glaziers are eager to explain that the sound of the diamond, depending on the thickness of the glass, tells them if the cut is sufficient.

Once the pane is set in place, all that remains is to hammer a few small headless nails on each side. The glazier sets them and hits them delicately with an iron hammer gliding along the surface of the pane and guided by it.

Meanwhile, our window is not watertight. There is a gentle play between the glass and the wood; the glass vibrates when the window moves. The putty waterproofs it and bonds it to the frame. The putty is applied at a slant with a right angle formed where the glass and the wood meet. It fills empty spaces, hides the nails, and lends solidity and homogeneity to the whole. The glazier smoothes it with a putty knife, the flat end of the iron handle of a hammer, a painter's spatula, or a simple square-blade knife. While a starstruck girl may dream of unattainable sumptuous diamonds, an engineer thinks of the rock drill of an oil well, or a naturalist links the small tool to the "egg breaker" (a bird's beak), the glazier is already on the street, casting reflections on the city walls.

The itinerant glazier (opposite), and his double tool (below).



AGRICULTURE

Twenty Trades on a Farm

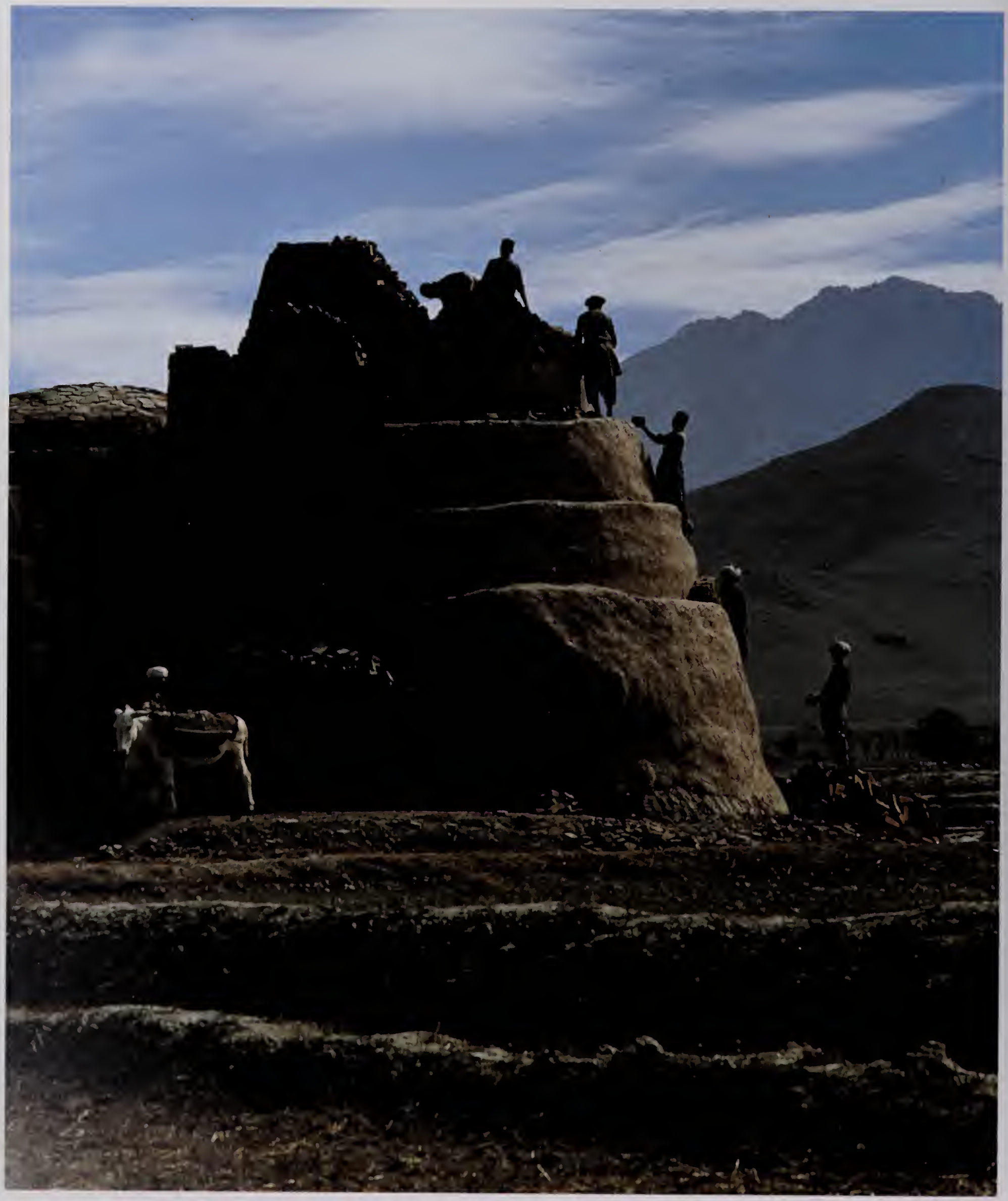
Whether it's in Mexico, Laos, or Mali, if a farm is isolated, it will need to be stocked with an arsenal of tools.

In a farm's toolboxes, on its racks, and in its sheds, you'll of course find the specialized tools necessary to produce grain, fodder, fruit, and vegetables, along with the ones needed for breeding or forestry. But things are continuous by nature; tools are related to each other and require maintenance, repair, and perhaps even replacement. A whetstone won't do on its own; one also needs a grindstone to sharpen a hatchet; and then a portable forge, and a hammer, tongs, and an anvil will be in order.

A variety of machines are used on a farm, and therefore farmers must have the basic mechanic's tools. They must know how to change a wheel, straighten a bent rail, and disassemble the essential parts of a motor. A farmer's toolbox will contain monkey wrenches, pipe wrenches, screwdrivers, and various kinds of pliers.

As part of the economic principle of self-sufficiency, farmers constantly monitor how their money is spent. If a skill is mastered, an expense can be avoided; instead of a purchase, food or services can be bartered. A young boy can receive all kinds of training by giving a farmer a hand. This is how he can learn how to pick a trench, spade, and shovel, as well as how to build a wall by shaping and cutting the stone with a facing

A French farmer's shed, circa 1930.



hammer and then taking and spreading the mortar with a trowel. He can learn to trim hedges with a pole pruner (that hook- or crescent-shaped billhook with a very long handle), to rough-hew a tool handle, connect wiring, and on and on.

These jobs are like what city dwellers do when they tinker in their apartments, garages, or country houses: a little building, some repairs, and a bit of handiwork. Because of the unique requirements of their profession, farmers will sometimes go well beyond their purview, skillfully completing a job that requires a diverse series of operations. One example is those Egyptian farmers who can be seen along the banks of the Nile building wooden posts for the doorways of their homes and preparing mud bricks for the walls. Another even more interesting example are those farmer-builders who find clay quarries. They combine the clay with chopped straw, blend it, and pile it into molds before letting the bricks dry in the sun. Then they fire them in a rustic, makeshift kiln. The result is beautiful, and the farmers' attempt to be economical is perfectly successful.

Farmers around the world are required to know about veterinary medicine and how to use certain basic medical instruments, and they must understand the chemistry of fertilizers and how to employ herbicides and pesticides. At night, or when they're keeping an eye on the children, women may spin and weave, elders often make or repair baskets and nets, and, in certain regions, when winter puts a stop to work, men can take the time to sculpt wooden toys or clock gears.

Spending a year on a half-dozen farms around the world would be the perfect experience for preparing someone to write an encyclopedia.

ON SERVING ONE'S COUNTRY

I know of no pursuit in which more real and important services can be rendered to any country than by improving its agriculture, its breed of useful animals, and other branches of a husbandman's cares.

President George Washington (1732–99), from a 1794 letter

Opposite: **In Afghanistan, bricks are made before a house is built.**

PIETER BRUEGHEL THE ELDER

Haymaking. **Narodni Gallery, Prague**

This great Flemish painter shows the whole world in a single painting. Haymaking, which is depicted here in full detail, is only a small part of a dizzyingly vast landscape. A close look at the artwork reveals a strange paradox. The scene's main character, the reaper (without him there would be nothing to rake, and nothing with which to fill the carts), is practically hidden in a dark corner at the lower left. He had been suffering in the heat and is now enjoying the shade of a tree while he hammers the blade of his scythe. He is completely focused on his work, paying no attention to the three young peasant women who pass by, chatting, with their rakes over their shoulders. The message is clear: in a team of workers it's not necessarily the ones who are the most obvious who are getting the most work done. This reaper is not resting—he's only doing a different kind of job. For him, there are no breaks during the day.

Sickle

With a scythe, the work is performed standing up, whereas with a sickle, the worker is forced to bend over. There are several kinds of each tool, with blades of various sizes and shapes, with different handle-blade angles, and different handles that are grasped in different ways. The silhouette of sharpened European hook sickles look like a question mark.

The first modern iron sickles were equipped with teeth, as if they were recalling their Egyptian ancestors (bowed wooden tools with sharpened flint "teeth" in their curved blade extended by a handle). Basically, a sickle wraps around standing wheat, cutting the tiny sheaves that have been gathered in the left hand. The sickle worker moves quite differently from the reaper, who wields the scythe with plenty of movement. With the scythe, the plants are dominated—seen from above—and left in heaps where they're cut. With the sickle, the wheat stalks are held, as if for certainty, while they are cut; because dried plants can blow away, the farmer brings them toward the sickle's blade with a needle (a simple large stick with a handle) or with various "gloves" and wooden finger pieces, which sometimes have joints and serve to protect the fingers of the left hand from coming into contact with the cutting edge. There is no waste with a sickle—not one wheat stalk is lost. This tool also allows workers to harvest in patches when difficult terrain restricts automatic or repetitive movement.

The toothed sickle cuts the handheld sheaf at close range. The longer sickle, like the "flying sickle," which is the most popular of French sickles, requires wider strokes. As the name implies, its sharpened edge moves in broadly and flatly.

The typical sickle is attached to its handle with a tang, the base of the blade is elongated, tapering into the shape of a long square nail which is driven into the wooden handle. The end of this nail is bent into a U shape so that the blade doesn't move, and the top end is held steady by a ferrule, a metal ring.

Nevertheless, some sickles—like the kind used in Greece and Pakistan—were built differently. The bases of these blades fit flat into a groove in the handle and were fastened with screws and rivets. When toolmakers used this method, they had the advantage of not having to perform delicate drilling on the handle—which weakens the tool—and they could also replace the handle quickly if need be.

Cylindrical and curved handles afford two more ways of doing, and perhaps, of being. With one, workers "sweep" from right to left, and with the other, they pull the tool toward their body, their hand grasping the handle's hook. The handle's bend acts like a guard, protecting the hand from hitting the sharp, short, and stiff stalk stubble. The angle made by the sickle's handle and blade is such that it can be brought right up to the ground, no matter how uneven it is, "shaving" all kinds of plants as closely as possible.

The smallest sickle in the family belongs not to the worker in the field who tackles large projects, but to the old woman who is still able to complete odd jobs. Each day, for example, she goes to collect some grass for her rabbits. Her gestures are smaller and less repetitive.

In Asia, you'll find a sickle used to cut rice. It is worked by a person who crouches down and presses the plant against the blade held between the index and middle fingers. The blade is driven into the handle perpendicularly. It's another world.

Opposite, above: **An Iranian reaper with a sickle shaped like the beak of a bird of prey.**

Opposite, below: **New Kingdom Egyptian painting depicting peasants at work.**

BOAZ ASLEEP

In Ur and in Jerimadeth all was at rest;
The deep and darkened sky sprinkled with stars;
Amid these flowers of the shade, the fine and
crescent moon
Was shining in the West, and Ruth was wondering,
Motionless, her eyes half-opened underneath
her veils,
Which god, which harvester of the eternal summer
Had, as he went away, negligently thrown
This golden sickle in the field of stars.

Victor Hugo, "La Legende des siècles"
("The Legend of the Ages")

Scythe

This is a uniquely shaped, unmistakable tool with a very long handle and two transverse grips. The farmer uses it standing up, but its aetion happens low to the ground. It's a tool made to be used in summer in wide-open spaees. It should be used in solitude, for its movement forms an arc. Its blade is thin, light, and shining, and its tip eurves like the wing of a small bird of prey. A rib keeps the blade steady, strengthening it on the other side of its cutting edge. The scythe's blade is attached to the handle in a unique way: a ferrule securely binds the blade to the end of the handle, holding it tight with a triangular wedge or a thiek wing nut. Therefore, the blade ean be removed. Because of the length and sharpness of the cutting edge, its perpendieular mass and uneven weight, and because the blade might come loose, the reaper's tool cannot be easually thrown over the shoulder and forgotten.

Traditionally, the scythe was used for haymaking, whereas the siekle was used for "sawing" the precious wheat. The scythe is equipped with a very light receptaele that colleets the eut plant. When it is filled to the point that it affeets the scythe's movement, the reaper empties it onto the ground, thus leaving work for the rake and fork.

The reaper in motion is astonishing to behold, resembling an African daneer whose feet never leave the ground. The axis of the body—with the spine pivoting on the arch formed by the legs—rotates the blade, whieh is connected to the arm via the handle. Contrary to what one might think, reaping is about lightness and finesse. Reapers don't force the tool; rather, they listen to it whistle. Thus they preserve their stamina, for, over the eourse of a day, the same movement will be repeated hundreds of times. Because the blade needs to be hammered and sharpened regularly, the worker does have the opportunity to change activities and position; these moments are considered a rest, a break.

The scythe, the tool of July's sunlight, of gathered abundance for the off-season, threatens with its long blade, moving seeretly and quietly, leaving the traces of its merciless leveling behind. The old man waving about an hourglass and armed with a scythe was to become a symbol, an allegory of Time. We also cannot forget the skeleton, our old comrade, death's envoy, who never loses. He is the ultimate harvester.

Teams of reapers in Turkey.

Mirror Sickle

CYPRUS

During the off-season, I found myself alone in a hotel in Limassol, Cyprus, and befriended the young owner. We would speak briefly twice a day, and I noticed that he was politely refraining from asking me questions. But when he saw me coming in from my harvest one night happily holding a heavy pair of metal snips, he could not hold himself back from asking what I was doing with such an object. I told him about my passion for tools and about the study I was engaged in. His face lit up. It turned out that he was going to visit his family in the country that Sunday and would bring me back something. I thanked him in advance and started to inquire about the kind of object, but he didn't want to tell me too much, since speaking about something before it happens can bring bad luck. All right. I would wait until Monday, and I wished him Godspeed.

God was on his side. I recognized the silhouette of a very large sickle wrapped in newspaper and string. Once the packaging had been removed, the sickle appeared, monumental and graceful. I spoke to the man of its supreme elegance; the finesse of the blade fastened flat on its long, ornate handle. I noted the small mirror that embellished its base. He asked me what such a decoration could mean. With all the sun, dust, and searing wind, reaping is not easy work, but reapers speed up when they think of the great closing celebration they'll enjoy when the work is complete. There will be eating, drinking, singing, and dancing, and the tool, the worker's companion through sweat and labor, will be a guest of honor. With pride in their adroitness, young men will dance and wave their sickles about. And the mirror, of course, will send messages of light into the eyes and hearts of young women.

I asked how he had acquired this tool. He told the farmer that he would give him what was necessary to buy a brand-new sickle. But the farmer wasn't interested. And so? "I convinced him by telling him that this kind of tool was unknown in France; that it would become a treasure and that people far away would speak of us."

The sickle, a tool for both work and play.

Previous pages: **Peasants' march, northeastern Brazil.**

Rice Cutter

PHILIPPINES **Ifugano tribe (North Luzon). Late nineteenth century.**

Resting on a table, this object is reminiscent—a good sign—of a Brancusi sculpture, a shark, its fins indicated by a small metal triangle. Its immediately recognizable body arches up, charging toward the surface. The shark is momentum. With use, the sculpted buffalo horn takes on a sheen, and the flanks of the object shine like an ocean dweller.

Yet, this object has nothing to do with art or the depths of the ocean. It's a tool used by Philippine peasants to harvest rice.

Despite its dynamic unity, it is composed of three parts. The cylindrical section is the tool's handle, which the hand grasps. The fingers wrap around this stalk, marrying its contour. The iron blade is carefully placed between the index and middle fingers. Thus these two fingers can grab hold of a small bunch of rice stalks and press them against the triangular blade that will cut them.

One might wonder if the long, slender pointed tip—the handle's curved extension—is decoration, an ornament. When the tool is held properly, the answer is clear. This hook is used to bring a cluster of stalks of just the right size toward the blade.

It is not unwarranted to mention art in this context. A group of these rice cutters will vary subtly from one to the next. Here, the blade is elongated, curving up on the sides like wings or fins; its bowed tip definitely brings to mind a scorpion's tail. Does one not reap better with an embellished tool that may even be broken in?

Prehistoric Sickle

Made of sharpened stone, this ancient sickle found in Denmark marked a new stage—as well as a stopping point—in the history of technology. The motion of cutting grain stalks, bringing them toward you using a curved knife, had been discovered. The tool that made it possible for this to happen—the sickle, with its sharp hook—had been conceived. However, the metal used to make the tool had not yet been conquered, which, in architecture, would be like building a long bridge without reinforced concrete. Except for very rare cases, such as the ceremonial objects of ancient Mexico, sharpened flint has undergone only basic shaping and designing because it is so fragile. The ancient stone carver opted for just a slight curve, which enabled the tool to withstand being used. Sometimes biologists introduce us to such "experiments" in nature; they do not always succeed. In the world of tools, evolution shows us the attempts the human mind made with various substances that were at hand.

Function meets elegance.

Sickle for Harvesting Rice

CAMBODIA

This tool, used to reap rice, is composed of four parts: a rounded handle made of hardwood with sprout-like decoration; a cylindrical intermediary piece made of light-colored wood; a slender piece of darker wood, very long and hooked; and a short iron blade equipped with saw teeth.

The tool can be used in two ways and leave reapers with one free hand. First, working to the left with their palms facing down, the workers will use the wooden hook to gather stalks of rice and grab them in their hand. Then, flipping the tool over, palm facing up, they can cut the bunch that has been gathered.

Another element—the worker's position —intervenes in the use of this tool. The Cambodian farmer works crouched down, just above the ground.

There are other tools that can perform two or more operations, but this one is remarkable since it asks only that the hand be turned over for its role to change.

Stalks can be gathered with a stick or even the piece of wood that protects the worker's hand from the sickle's blade.

In a double homage paid to tools, Julio Gonzalez's hammered iron statue *Montserrat* (1942), depicts the life of a Spanish farmer, child in her arm, sickle in her hand, her scarf blocking the heat of the sun.

HAMMER AND SICKLE

The crossed alliance of these two tools was once the official emblem of the Soviet Union. It eloquently represented the union of farm and industrial workers, as if the factory's field and the city's farmscape, far from being at odds, were joined, reaching together. The objects share some characteristics—they are both basic tools for striking, striking; they are our very basic, and they're composed simply of a metal piece that makes contact with another element, and a rounded, straight wooden handle.

The symbol soothed the eyes, for the objects complemented each other because they were different. The hammer is obviously heavy, loud, perpendicular, violent, and virile. The sickle appears lighter, sharp and curved, traditionally symbolizing nature's "gifts"—peace in the fields, fertility, women. Their shapes determine how they should be handled: the hammer strikes down in front, vertically, and the sickle is worked horizontally in smooth, light circles. The combination of the hammer's solid metal mass and the sickle's thin curved wing creates an indisputably rich emblem with a most elegant graphic quality.

The great photographer Tina Modotti has presented this proletarian portrait which is both simple and powerful.

The German Democratic Republic improved half the symbol, the hammer, and coupled it with a measuring instrument, the compass. This composite stood for precision and construction and strove to be the emblem of white-collar workers.

Still life re-creating a political emblem, photographed by Mark Alexander.

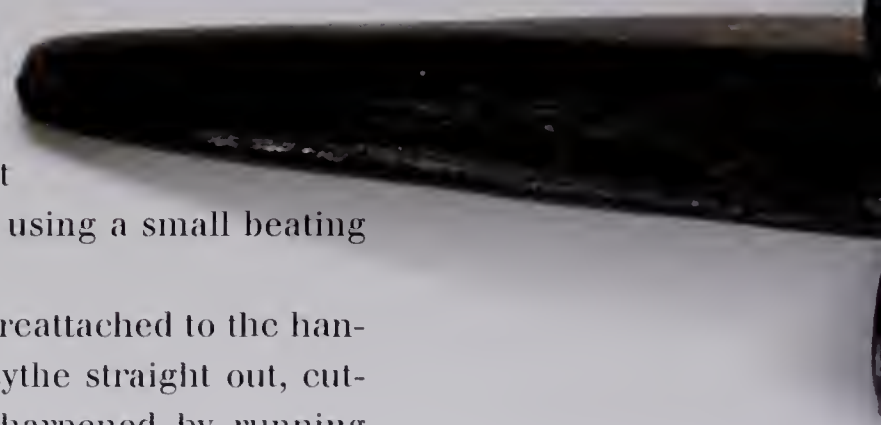
The sharpening stone fits inside a bassinet, which is worn on the belt.

The Scythe's Companions

The scythe's blade must cut like a razor. Its particularly delicate cutting edge can bend when it strikes a twig or, worse, it can chip upon hitting a stone. Reapers will feel something has changed; they will sense that the scythe is no longer gliding through the wheat stalks and that occasionally something is holding it back, that it is caught.

Then they must stop to hammer the blade. They will take out a large metal stake known as a portable anvil from their satchel, which sits on the side of the field, and drive it into the ground with a small hammer. When the portable anvil's metal guard, which is shaped like a four-leaf clover, meets the ground, the anvil is wedged in deeply enough and can act as a stable support for the next step.

After separating the blade from the handle, either by removing the wedge that locks the iron ring or by unscrewing the wing nuts that hold the blade and handle together, the worker can straighten out the bent or nicked blade. He sits in front of the portable anvil, using a small beating hammer.



Next, the blade is reattached to the handle by holding the scythe straight out, cutting edge up. It is sharpened by running a scythe-stone, traditionally shaped like a

The short hammer used for beating the blade.

long boat, along the length of the blade. Before returning to work, reapers will put the stone back in the case they wear on their belts, usually in back, so that it doesn't get in the way. This case is called a bassinet, and depending on the region and its traditions, tastes, and customs, it might be made of wood, metal, or even steer horn. A prudent reaper will keep a dampened rag (or tree leaves) inside it, because a wet stone will not damage the blade's temper with too much heat.

These associated objects are so indispensable to reapers that they could be considered to be an inseparable family. Farmers often string them together so that they won't get lost or left behind.

When passersby hear the rapid strokes of a small hammer in the country during harvest and haymaking time, they are reminded that one cannot reap without constantly maintaining one's tools.

The portable anvil is planted in the ground.

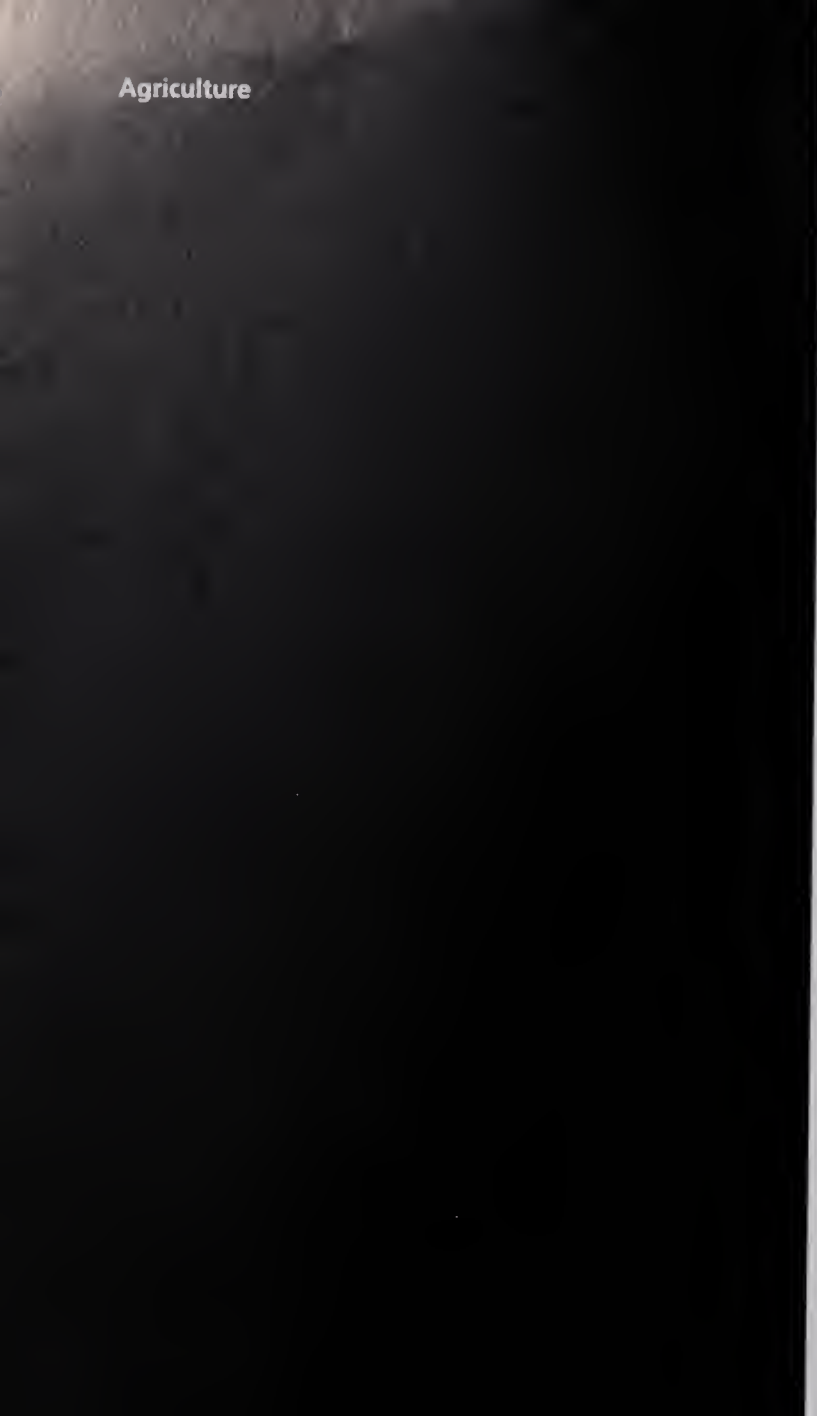
SEYSSAUD

The Reaper, 1920.
Toulouse-Lautrec Museum, Albi, France.

We are so far from Madame Sévigné's smiling hayworkers, Poussin's peaceful peasants, and Millet's noble workers of the land!

By using breathtaking contrasts of dark and light and choosing to portray his subjects working alone, often from behind, René Auguste Seyssaud adds a raging, frenzied dimension to a peasant's work. The workers stand off-balance, their gestures border on the excessive, and the action is met with as much commotion. There is chaos on the ground, and the sheaves and stalks of wheat cover the land like bodies on a battlefield. The reaper doesn't have the time to tidy up, to arrange. Others will do so after he's done. He must move on; because the day is never long enough, because the job is so immense, because what's not done today will have to be done tomorrow, because it's hard, bitter work for little pay on other people's land . . . and on top of it all, because a storm is on the horizon, rumbling. The job must get done, and the worker must persevere, marking boundless circles with the scythe.

Seyssaud most definitely contemplated and understood these driven workers. What he saw, he painted with vibrant colors, bringing his subjects to life through the vigor of his brush strokes which, alone, are able to capture the reaper's position and motion. He identified with his subject, handling his brush as a harvester handles a scythe, with big, direct, and rapid strokes.



Opposite: **For a plant to create a hoe like this, its growth must be guided.**

Wood Fork

The micocoulier is a tree from the elm family, common in warm and tropical regions, notably the south of France. Its wood is dense and tough, which is why it is used to make canes and tool handles.

In numerous civilizations, people have used the natural shapes of a plant to aid them in making a tool. A blade might be attached to the beak-shaped angle of a branch and thus form a hoe (Africa) or an adze (Oceania); the knob of a branch could become a dibble; a triangle of branches taken from the trunk might make a three-legged block. This fork, however, is different: it is not found, but rather created from the living tree. After an appropriate area of the tree is selected, the wood is hewn until there are only the three or four branches—the fork's prongs—at the end of a branch. Their shape is maintained by wedges that separate them and give them the curvature necessary for working with hay, grass, or straw. These wedges stay in until the tool is removed from the tree.

Certain forkmakers have taken to tastefully decorating their tools by wrapping twists of ribbon around the handle before applying walnut stain. The unstained areas that are left create a most beautiful effect that also serves to identify the tool.

Jules Dalou's Great Peasant

In 1897, the sculptor Jules Dalou (1838–1902) wrote, "Without further delay, I have resolved to start the monument in praise of workers that I have dreamed of since 1889. The subject is in the air: it belongs to our time and will be contemplated in another. The moment has come. The future is here, and the cult of the future will replace the myths of the past." The *Monument to Labor* was never finished as such, but some elements of it do exist, like this beautiful *Great Peasant* (Musée d'Orsay), depicting a farmer rolling up his sleeve, his tool lying at his clog-bearing feet. Pensively, he stares at the land and toward the day ahead.

Dalou knew all about manual labor and was able to evoke work without depicting it directly.

Liadou

The liadou is made from a single piece of wood. It has a pointed, upturned axis, a handle, and a flat disk below the handle. The tool will become polished as it is used, and the bottom of the disk will bear deep traces of wear through friction.

The name says it all. Liadou, a tool special to the French Corrèze region, means "to act as liaison." Sure enough, this tool—made right on the farm or by a local woodworker, such as a clogmaker or carpenter—is used to bind bunches of wheat. The farmer gathers the reaper's cut harvest with the long, pointed end. The central piece protects the hand from the stalks on the ground, which can hurt as much as just as many prickles. Once they are gathered, the farmer will place the sheaves under his or her left arm and tap their base with the round of the liadou so that the stalks even out in terms of height. Then the sheaves are belted, most often with a straw tie. The tip of the liadou is slid between the tie and straw and turned several times to tighten the binding around the sheaves; because it is tapered, the tool can then be easily removed.

The liadou was never imitated or borrowed in other regions of France. The fact that it was ignored shows just how significant mindset and habit are to process.

A recent ethnographic study, however, has caused an increase in the production of the liadou in the Neuvic region of France, "so that it would not be forgotten."

Flail and Winnowing Basket

On its course from standing stalk to grain, wheat must undergo several procedures after reaping. Once they are carefully bound together with a strong tie, the sheaves are brought back to the farm. There, they are untied and spread out on a surface where the grains are beaten from the chaff with flails. Often a team of workers will thresh together, following the worker with the quickest rhythm.

The flail is a bat attached to the end of a long handle by a joint. The top part of the flail correlates perfectly to the grain that is laid out horizontally on a flat surface. Depending on the era and region, the hinge linking the two parts of the tool might be

The liadou: sometimes a shape will speak to us.

In Millet's *The Winnower* (Musée d'Orsay, Paris), the winnowing basket is open and can be used like a shovel.

two iron rings, a short metal chain, or two large leather-strap loops. What's important is that the farmer work as smoothly as possible in a circular movement.

The inhabitants of an African village will thresh with long supple rods. Flailing stances and gestures are different in Europe, where, depending on the region, the flail's beating part may have the proportions of a plain cylindrical stick, or instead be shaped like a flat board reminiscent of an oar's blade and weighing as much as one as well.

The most ingenious device that has been invented for threshing is the joint made of steerhide or eelskin (which can withstand anything) that rotates in a notch at the end of the handle. With this, the workers do not have to break their rhythm after each stroke: the handle will twirl the bat back over the wheat.

Once it seems that the grain has been beaten out of the chaff, the mixture of grain and chaff passes to the winnower. The winnow is a large slanted basket bin with two handles. It is used to toss the grain and chaff into the air in order to bring the grain, which is heavier, into the deep part of the basket. There are two dynamics at play at this stage: human energy from the farmer's arms, and natural energy, the unimpeded but capricious power of wind. A breath of air will carry the light chaff far away. But an entire summer day can pass without wind. In this case, one must call to the wind gods for help, as did sixteenth-century French poet Joachim du Bellay in these wonderful verses:

FROM A WHEAT WINNOWER, TO THE WINDS

To you, lightfooted flock,
That flies through the world
On fleeting wing
And gently sways the
Shady green
With whistling murmur,

I offer you these violets,
These lilies and these flowerettes,
And then these roses here,
These vermillion roses
Just barely opened up,
And these carnations, too.

With your sweet breath
Fan the air of this plain,
Fan the air of this retreat
While I strain with
My wheat that I winnow
In the heat of the day.

***Jeux rustiques* (Rustic Games)**

Opposite: **Women working their flails in Bhutan.**

African Hoe

For European farmers, the shape of this hoe from Mali defies common sense. They wonder if it might have the exact opposite function of the tool they have used since time immemorial. Both because of the build of African farmers and their "body habits," the handle of the hoe is very short. Slender in build, African farmers will balance on spread legs to work, backs hunched over the ground. The acute blade-handle angle requires that the worker swing the tool rather than wave it. The blade's width is well suited to plowing light, dry, and crumbly soil, and its weight can be used to the farmer's benefit. It would take more strength to pull up the blade when it is used in heavy, wet, and compact land.

European farmers don't like to crouch, and they hate to double over toward the ground: they have therefore opted for a long handle that practically forms a right angle with the strong, narrow blade.

It is known that African workers shortened the handles of European-made tools distributed among them, and during World War I, French sociologist and anthropologist Marcel Mauss noted that British Empire army regiments wouldn't use the tools left behind by their predecessors to dig trenches.

This tool, which is used in a ritual to mark a circle around a grave, is reminiscent of ancient Egypt, from which it is not in fact so distant.

This bailer from Vanuatu accompanies the resourceful seafarers of Oceania.

Spade, Shovel, and Bailer

Comparisons are more effective than definitions at capturing the essential nature of things. What distinguishes the spade from the shovel is not apparent to the average person. It seems we could use either tool indiscriminately to complete a given job; and for the occasional task, practice has shown that this is true. However, if a movement is repeated over and over, a tool's inadequacy for a specific goal will blare out. The amateur is likely to use any tool at hand if it is more or less appropriate, even at the risk of damaging it; but for the professional, a tool is meant for a specific purpose, and using it for any other job would be a waste of energy.

The spade, which is driven vertically into the ground—by stepping on its side if necessary—cuts and separates a portion of ground when you pull the handle back. The soil collected on the tool's blade can then be tossed to the side, forming a pile near the hole that has been dug.

The very shape of the shovel asks that it be used at a slant. Workers will shovel what they need to—a mason will use it, for example, to take sand from a pile. A shovel could be described as a metal tray at the end of a long handle. The bailer, which is used for drawing water, is a large, deep spoon with a short handle that will scoop up water, which can then be removed by emptying it over the side of a boat.

The action of spading can be broken down into three steps: planting the tool, levering it up, and dumping the soil. The process is the same for shoveling: embedding the tool, pulling it out once it's loaded, and emptying. Bailing is much quicker: the tool isn't used to hold water in order to transport it, but rather to gather and pour in the same movement.

The World of Homer

The Test of the Tool

On the outside he is composed as always, but, in fact he heads toward the unknown with trepidation. Odysseus is going to the underworld. This insatiable wild man wants to know his future and calls to the prophet. Tiresias of Thebes foresees the hero's victory over Penelope's suitors, but sees no end to his adventures. Polyphemus, the Cyclops Odysseus blinded, is one of Poseidon's sons, and the god of the sea has not forgiven him and will relentlessly hunt him down.

The only way for him to escape Poseidon is to distance himself as much as possible from the sea, and head inland, Odysseus is told.

Others would be satisfied with the soothsayer's logical solution.

But, as an islander, Odysseus believes that by going far inland, he will eventually cross the island entirely and find himself facing the sea, the domain of the dreaded god. He therefore asks how he will know when he has reached this "far off" point, this happy refuge.

The soothsayer tells the roaming seafarer that he will have to march straight ahead, with his solid oar on his shoulder. Eventually, one day, he will meet an ignorant people who do not mix salt into their food; nor would they have seen red-painted boats passing. The oar, the ship's wing, would be unknown to them. In fact, they would think it was a winnower's shovel he held on his shoulder.

Then and only then can he be sure of having reached the land of plenty where he can bury his oar in the ground. This will mark the end of his voyage. He will have escaped the sea; he will have arrived.

Homer never said that the oar would be taken for a weapon, pole, or door beam. Farmers would immediately see it as a winnower's shovel used to throw the grain into the air while the wind takes the chaff away.

Upon recognizing an object, one knows how it could be of use, and considers only that. Tools are precious. Every tool becomes a farmer's tool. The farmer can read the logic of a tool's shape—a handle, a flat surface—despite its differences.

Incidentally, one considers the tools travelers carry on the road. They take what they need to show what it is they do, so that they aren't naked, so that they can work, defend themselves, and live. It is their closest relative. Their tool.

Opposite: **Ancient Greek sailing ship. The oars act as a rudder. Cup of Nicosthenes. Fifth century BC. Musée du Louvre, Paris.**

Tool used to cut into the trunk of the tree.

The Tools of the Resin Gatherer, or Pine Sapper

This trade is practiced in southwestern France, where the coastal pine trees of the Gascony forest grow. Three centuries ago, pinewood was burned for tar to caulk the bottom of skiffs. Later, pine resin was to be gathered in large quantities for the production of turpentine and rosin, which have an infinite number of uses. Turpentine can act as a solvent and especially as a varnish; rosin has various industrial and more sophisticated functions. It is indispensable to dancers, who apply it to their slippers so that they won't slide; violinists, who glide it over their strings, and acrobats, who rub it on their hands, as do numerous athletes, before working out with equipment and weights.

The pine sapper at work.

Pine sappers will first remove some bark with an ax, shaping a very long oval surface. They will then attach a metal tap at the bottom of this area for funneling the resin into a clay pot they hang underneath. Finally they'll jab the trunk with the tool's sharp, hooked blade. Once this has been done, the worker only needs to check the trees regularly and collect the sap (approximately once a week). Each time, a new incision is created above the previous one with a tapper's gouge, and the tap and receptacle are adjusted to the right height.

For economic reasons, the sappers' profession is now practically extinct. There is, however, a plan to support a few sappers so that they can continue this work, in the name of preserving a precious living heritage.

Scoop for Cleaning Plowshares

CYPRUS

The farmers of Cyprus are accustomed to attaching this tool, which looks like a lateral spoon, to the end of a goad (the long pole used to nudge steer to work). When farmers rest at the end of a furrow, they use this object to scrape the plowshare to remove clumps of moist soil that may have gotten caught.

Its ferrule is V-shaped and can, with a couple of strokes of the hammer, be fitted around the chosen handle. To be safe, blacksmiths have drilled a round hole in the iron for a nail, which will act as an extra fastener.

A tool made to fit the worker.

Sebastião Salgado has photographed the all-purpose tool, held here by Brazilian workers.

Machete

From the Rio Grande to the southern tip of Chile, each and every farmer will unhesitatingly sing the praises of the machete and demonstrate its uses. Not a single worker from the fields, prairies, or forests would ever give up this flat broad-bladed sword. It is a bare essential for an entire lifetime, along with a straw hat, shirt, light pants, good belt, and, often, those long-lasting sandals with tire soles.

Machetes can be used to cut branches, especially thorny ones, for creating a path. With a machete, one can take down a medium-size tree, harvest cane or corn, chop and split firewood, and prune a trunk's branches and twigs. Central and South Americans are so accustomed to having a machete as their arm's extension that they will use its flat surface like a crop on a horse's hind end to encourage it to move along.

Not referring to the work of any particular farmer, a Mexican farmer taps his somewhat scratched leather boot and asks, "What do you use to dig up the earth to make dried clay bricks? What do you use to pile soil into the mold? What do you use to chop the straw? What do you use to stir the mixture?" The grand finale: "You want to hew a pencil?" With a machete, "all you have to do is run the blade two or three times over a flat stone." Being in the company of such a tool shapes your outlook.

Corn Sheller

Native North Americans

Corn kernels are wedged onto the ear, making them hard to grasp. You therefore have to start by attacking one part of the ear's mosaic. Once one area has been cleared, the other kernels can be dislodged. You can comfortably hold this bone stake by its leather strap, which will prevent your hand from cramping. The tool can start the job off, and even complete it by following the long rows down the ear.

In other countries, this job is carried out without a tool: one hand will hold the kernel-filled ear, pushing it (for example) to the right, while the other moves to the left. The kernels fall into the bowl.

Because the same need can yield similar solutions throughout the four corners of the world, it comes as no surprise that Hungarian corn farmers have fashioned a small hard wooden nail to remove kernels. A hole at the nail's widest part accommodates a leather strap by which the object can be properly held in the hand.

Overleaf: **Woman digging an irrigation channel in Rajasthan.**

A simple invention can make a job less difficult.

A Winegrower's Tools

Carpenters can plane their board when it's convenient, and blacksmiths can stop pounding their iron when they please. But such is not the case in the country, where, every day, animals are waiting to be fed and given water, and where plants dictate the farmer's schedule.

The farmer bows to time and the weather. City dwellers can practically ignore the seasons and avoid the heat and cold. But farmers know they must harvest grapes in the fall and bring the olives to the press in December.

The tools used to work and maintain vines could be lined up in the order in which they are used—and this is pretty much what happens.

The first question that comes to mind is: Why is so much maintenance necessary when good soil will nourish a plant, allow it to take hold and grow; why, when the sky's gentle showers, the mild climate, and sun's warmth do the rest?

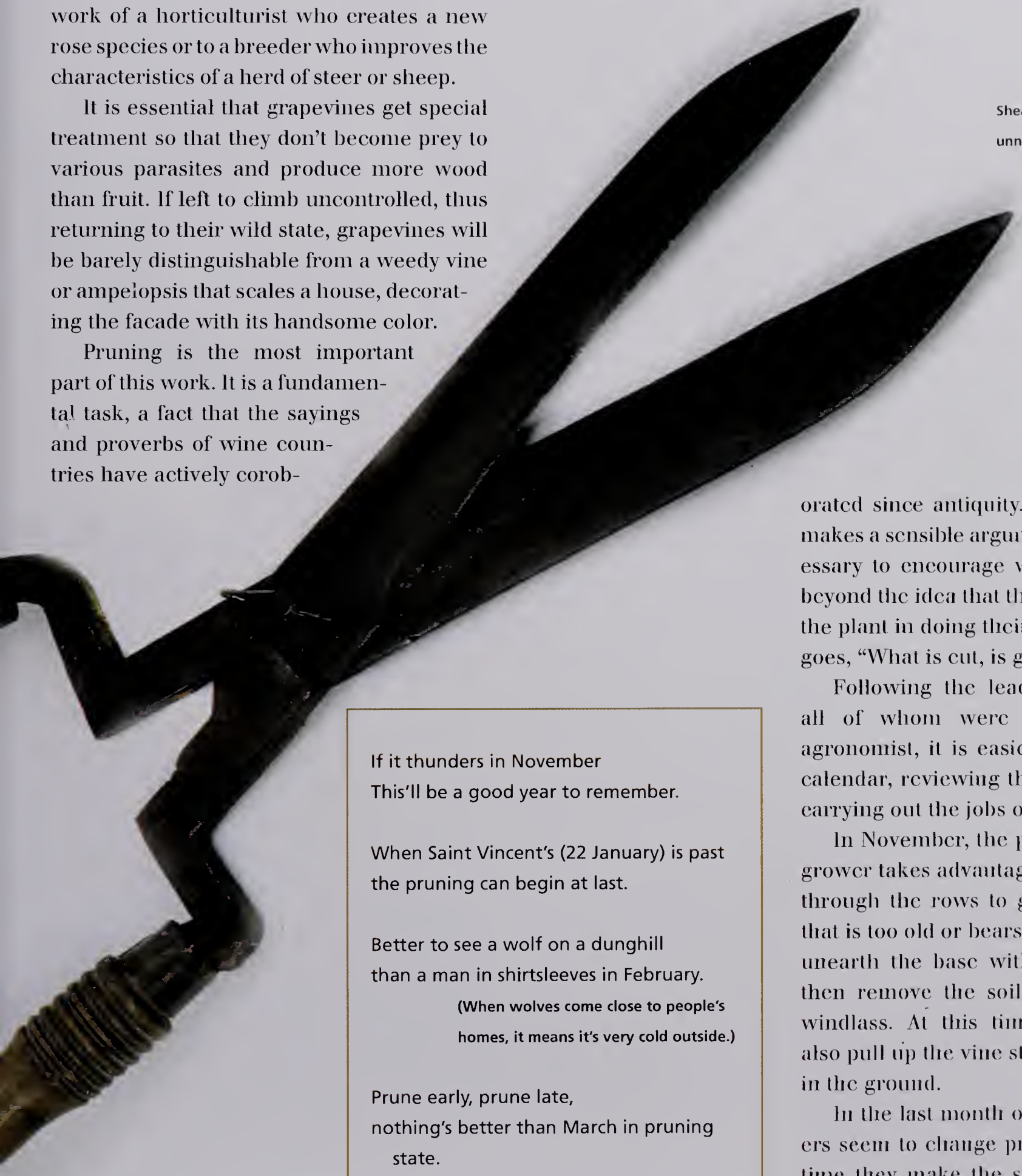
The answer is quite simply because the vine, which was grown long ago by the ancient Egyptians and most likely brought to the south of France by Greek settlers many centuries ago, is not a pure product of nature. Grapevines as we know them represent a human victory, an intelligent, patient partnership between humankind and the

With this tool, the winegrower is able to aerate the soil around the base of the plant.

forces of nature. The work is detailed and repetitious, comparable in every way to the work of a horticulturist who creates a new rose species or to a breeder who improves the characteristics of a herd of steer or sheep.

It is essential that grapevines get special treatment so that they don't become prey to various parasites and produce more wood than fruit. If left to climb uncontrolled, thus returning to their wild state, grapevines will be barely distinguishable from a weedy vine or ampelopsis that scales a house, decorating the facade with its handsome color.

Pruning is the most important part of this work. It is a fundamental task, a fact that the sayings and proverbs of wine countries have actively corob-



Shears will clip off unnecessary wood.

orated since antiquity. One piece of advice makes a sensible argument (as if it were necessary to encourage winegrowers to move beyond the idea that they wound or mutilate the plant in doing their work): as the saying goes, "What is cut, is gained."

Following the lead of ancient writers, all of whom were half poet and half agronomist, it is easiest to go through the calendar, reviewing the tools necessary for carrying out the jobs of each month.

In November, the plant rests. The winegrower takes advantage of this time to walk through the rows to gather the vine stock that is too old or bears almost no fruit. They unearth the base with a special pick and then remove the soil with a rudimentary windlass. At this time, winegrowers will also pull up the vine stakes so they don't rot in the ground.

In the last month of the year, winegrowers seem to change professions. This is the time they make the sticks and stakes they will need, using acacia, a dense, solid, and strong wood. The trunk of the tree is divided in four with a splitter (the blade is attached to the handle at a right angle, cutting edge facing down) which itself is struck with a mallet. A billhook will be used (the same tool

If it thunders in November
This'll be a good year to remember.

When Saint Vincent's (22 January) is past
the pruning can begin at last.

Better to see a wolf on a dunghill
than a man in shirtsleeves in February.
(When wolves come close to people's homes, it means it's very cold outside.)

Prune early, prune late,
nothing's better than March in pruning state.

If in April thunder is heard,
get your harvest casks prepared.
(April storms and rains herald an abundant harvest.)

Winegrowers have an impressive array of tools, which allows them to choose one that fits both their grip and the job at hand.

used by lumberjacks and foresters) to give the wooden stick a pointed end.

It's also necessary to think about the future and renewal. In this same time of year, farmers prepare the land for planting vines. They will use different kinds of picks and spades—including the two-pronged hoe and the two-pronged hoe with a blade—depending on the nature and condition of the soil. A billhook is used to resharpen the tips of old stakes so that they can be driven into the ground more easily.

To obtain the best exposure, it is best to align vine plants on hilly terrain. The year's rainfall will have moved some good, precious soil to the bottom of the vineyard. After breaking the soil up into clumps with a pick, farmers will carry it back up the hill on their backs in the same basket used by grape pickers.

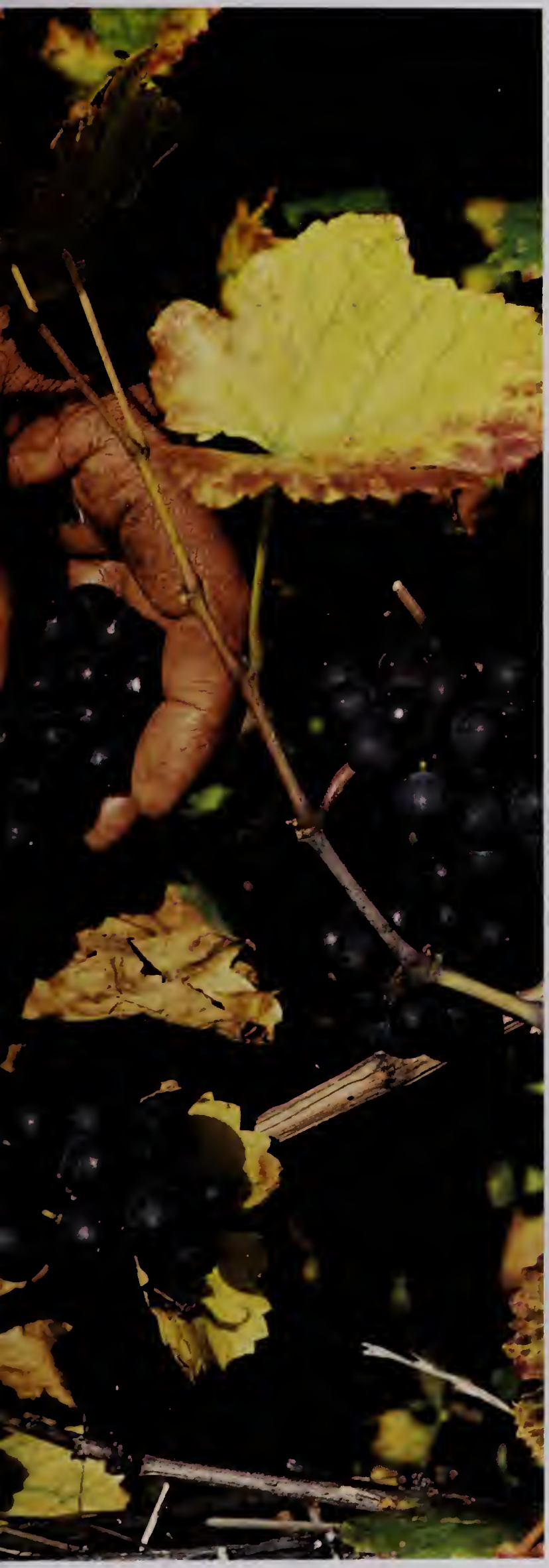
A profession and its corresponding tools must not be thought of as parallel lines that never cross. In fact, quite the opposite is true in the world of work since specialties overlap and borrow from each other. The winegrowers' profession consists of many different steps, and in this season, for a certain time, winegrowers draw upon a winnower's expertise and tools, in preparing wicker ties, for example. Armed with a pruning knife, winegrowers will cut twigs and then divide them in three with a splitter, always a fascinating process.

Although they are not actually winnowers, winegrowers clearly practice basketmaking. They choose and pick twigs, splitting them in three, which is the first step of a winnower's work.

Once February has arrived, it is traditionally time to replant the vine stakes and adjust the wire that will hold up the vine. It's also time to think about cooperage, about cleaning the barrels that will hold the wine from the previous harvest. But the land won't wait, and, at this time, the flat-bladed pick is used to dig about four inches into the ground at the base of each vine stock.

Come March, it's time to prune, a procedure that is as essential as it is complex. A vine that is left to grow wild would produce stunted grapes that would never mature. However, excessive pruning can hinder a plant's natural

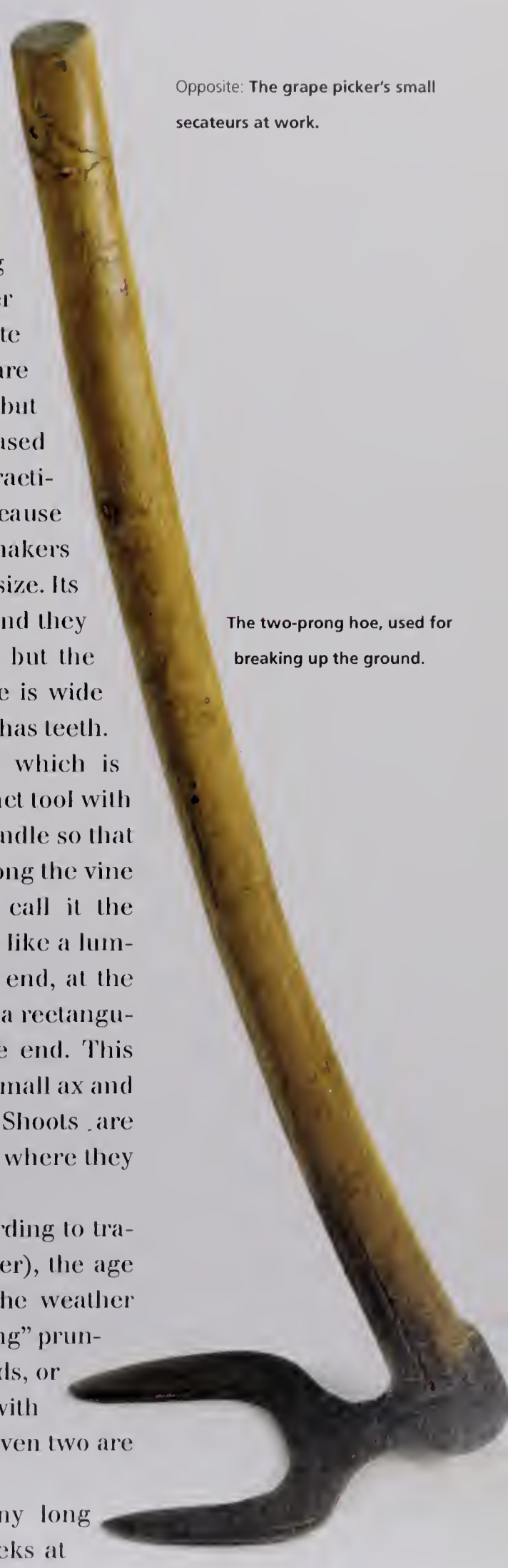
Opposite: A man of the trade using his secateurs.



Opposite: **The grape picker's small secateurs at work.**

growth pattern, preventing the plant from spreading. One must always keep in mind that the vine is not a tree—it's a creeper.

Tools will vary in shape and size. The one used is chosen based on the part of the vine meant to be cut. The large shears are employed for cutting the biggest vine shoots right above the ground. Their two wooden handles act as two long levers and allow the winegrower to cut the vine's hard wood quite easily. In their outline, they are reminiscent of wire cutters, but they're obviously meant to be used with two hands. They are not practical for other parts of the vine because of their bulk. Therefore, toolmakers create the same tool in a smaller size. Its two handles are made of steel, and they are worked with just one hand, but the blades are shaped the same: one is wide and spear-shaped, and the other has teeth.



The two-prong hoe, used for breaking up the ground.

The winegrower's billhook, which is also used for pruning, is a compact tool with two cutting edges and a short handle so that it can be easily manipulated among the vine rows. On one side—we could call it the front—the blade is often curved, like a lumberjack's billhook; on the other end, at the "heel" of this first blade, there is a rectangular blade sharpened only at the end. This part acts and cuts cleanly like a small ax and uses the weight of the tool. Shoots are pruned with this end because of where they are located. They are not sawed.

Pruning practices differ according to tradition and region (cold or warmer), the age of the vine, its fecundity, and the weather conditions. What is known as "long" pruning will eliminate all but four buds, or "eyes," from the vine, whereas with "short" pruning all but three or even two are cut back.

Because it is used for many long days, sometimes for several weeks at

a time, the winegrower's billhook must be perfectly adjusted to the worker's hand and way of pruning. The stone used to sharpen the cutting edges will wear them down, and therefore it is necessary to occasionally have a blacksmith produce a new billhook from the model provided. This is why there are infinite forms, as varied as the profile of heads of birds, perhaps designed by an Italian specializing in his country's northern vineyards. This tool is as personal as the pocketknife. Farmers will often tell you that they have adapted each and every one of their tools and that they wouldn't exchange them for the world. No matter what modernizing improvements have been developed, farmers keep the same tool throughout their entire working life.

The grafting knife enters the scene in April. Grafting has been practiced in Europe since the end of the nineteenth century when vine plants there were attacked to the root by a relentless parasite named phylloxera. The vines had to be uprooted and replaced by an American stock that was able to resist the disastrous blight. The grafting knife's blade is curved on one side, and very sharp and short on the other, and allows one to successfully complete the delicate cutting needed to introduce the graft. One of the plants will "carry" the other and, once the grafting is completed, the vine's strength and productivity will increase.

After, the plow is drawn between the rows. The spaces separating the vine stock in the same row are worked with a three-pronged pick.

The hole for planting a future vine is dug with a pick and then prepared with a dibble. Originally, this tool was made by the farmers and winegrowers themselves. Following the example of ancient populations, and, more recently, of African and Oceanic farmers looking to make a hoe or hook (not to mention present-day European boatbuilders who search for a perfectly curved piece of wood), these farmers would go into the forest to find an appropriately shaped branch, one with a right angle. One part would serve as a handle, while the other would be sharpened to a point. Since then, an iron version of the tool has been manufactured; and because it is hollow, it is light and won't wear down. These tools are painted in bright colors so that they are always

A tool's shape is revealing. The tip digs into the ground, and the sides slice the roots of weeds.

easy to find and can readily be at a worker's beck and call.

A pale (a type of aerating foot-operated hoe) is used for more compacted soil. This tool is actually a strong wooden frame with two perpendicular handles and a transverse bar for the foot to drive it in.

Clumps of earth used to be turned over with a two-pronged hoe. This task is now executed with a mechanical aerator, which is a farming machine with proper tracking that passes over the vine rows.

In the past, stakes were driven into the earth in the most basic fashion, with the use of a mallet. Since then, an ingenious and simple design has been developed that makes the work much easier. It consists of a U-shaped metal piece that pinches the stake at an oblique angle like a grip. In one of its variations, this piece is attached perpendicularly to a handle. In another, the piece is attached to the side of a wooden clog in which case the foot can be used instead of the hand.

Winegrowers have barely planted their stakes by May, when it's already time to pick up their pruning knives to cut back unnecessary shoots. They will smooth the soil with their flat picks and also weed. This kind of work is called harrowing.

By the time June rolls around, it will be necessary to treat the vines with sulfur to kill a fungus parasite known as oidium. It's also time to start tying up the vines, in other words, attaching the shoots to the stakes. The wicker used by our grandparents was replaced by raffia, which itself has been twined with remarkably strong synthetic ties that can withstand all kinds of weather and changing temperatures. Unnecessary vines are cut once more at this time and again, growers will plow with a special instrument that weeds while turning up the earth. The job is completed by hand.

It's clear that winegrowing is manual work. As opposed to workers on large farms, winegrowers can say that they have touched each vine plant with their hands. No one would deny it.

July is the month for sulfur spraying. Copper sulfate or iron sulfate on leaves will prevent cryptogamic infestations. Depending on the scale, size, and layout of the terrain, the chemicals will be sprayed by hand or machine.

In August, winegrowers cut the vine shoots that aren't producing any grapes, thus strengthening the others. To do so, they use shears resembling large scissors, a small pruning knife, or secateurs. Before the job is done, they'll once again pick around the base of the vine stock.

Come September, it's time to think about the upcoming harvest. First and foremost, the barrels have to be prepared; the staves must be cleaned and sprayed with water so that wood swells, ensuring that the barrel will be watertight. The baskets are cleaned and stacked, and the scissors used by the harvesters are collected and sharpened. This tool has the typical shape, but it wouldn't be confused with paper or fabric scissors because its blades are very short. Properly cutting the stem that holds a bunch of grapes is precise work repeated a hundred times.

Horn handle, slender blade, and grafting knife made of bone—a winegrower's companion.

A grape picker with a pruning knife in hand.

Because of the shape of this tool, harvesters barely need to move their thumb and index fingers, which are wrapped in the rings of the scissors. Thus, they tire less quickly.

Growers carefully choose a harvesting date in September and October. They'll examine their vine, taste the grapes, and scrutinize the sky. They'll consult their notebook about the previous year's weather at this time. A few extra days of sun could increase the sugar content in "the earth's blood"—but a downpour could ruin everything, rotting the grapes on-site. Subtle factors are at play, like the customs of the region and the kind of wine desired. And that's not even mentioning one's natural tendency toward prudence or risk.

The bunches are gathered in large vats. Then, tradition has it—to this day—that the heavier members of the team will tromp on the grapes. The winery manager must see that the work area is properly ventilated and must arrange to relieve the work teams, because the vapors from crushed grapes are heady.

This mash, which could be compared, depending how you look at it, either to a purée or a soup, is poured into a wine press. Grape juice abounds, sugary and turbid. At the bottom of the press, there remains a hard, dry, brownish crust that one might think should be thrown away. But this pulp of grapeskin, seeds, and stems has more to give. The brandy called marc is distilled from this residue, which is cut in slabs in the bottom of the press with a huge and heavy ax known as a marc cutter. The compressed mixture is cut mostly with the tool's weight.

This frugal mindset runs through various professions, drawing true similarities among them. For example, that yellowish cake that must be removed from the olive press is also used. This mixture of olive skin and crushed pit fragments can be burned in the oven that is used in making oil, or it can be sold to distillers who will extract industrial oil from it or even use it as fertilizer. An observer might never imagine upon seeing a press at work—and estimating the power at play—that there could be anything of value left over once the grape juice or olive oil is extracted.

Striking a good balance between the scientific knowledge that comes along with their subtle profession, flair (which is inexpressible), sensibility, and ancestral tradition, winegrowers are glad to take up the proverbs that governed vineyard work in the past—especially if it is to their benefit.

Blueberry Picker

This extremely clever tool has a double function: to separate berries from their plants and gather them in its back drawer-like compartment before emptying them into a basket. With the blueberry "comb," workers can proceed much more quickly than if they were picking the berries one at a time. Nevertheless, the tool has to be handled carefully so as not to damage the plant and thus jeopardize the next harvest.

This blueberry picker was made by an artisan, undoubtedly for his or her personal use. There is a metal-toothed commercial version that, since it could harm the plant, was sometimes even forbidden in certain farming districts in France (in Alsace and Savoy, two regions for which blueberry picking constitutes an appreciable source of revenue).

Even though this is a recently made object, its underlying concept was employed long ago. There is a great difference in size, however: a Gallo-Roman stele discovered in Belgium depicts a "harvester," teeth facing down toward the ground, compartment in the back, being pushed through the wheat fields.

History did not record the name of the blueberry comb's inventor.

The Tool and Hand of the Oyster Farmer

How to detach an oyster.

When it is time, oysters affixed to the cultch, the material that provides points of attachment, will be brought to huts where the oysters are removed.

The operation is delicate: a simple iron tool, a scraper, is used on the tiles, stakes, or slate of the collectors, and the cultch is broken up in order to gather the spat that have remained intact. The mollusks cling together, forming bunches of four, five, six, or seven. The shells are still too fragile to withstand the pressure of the lever tool. The oyster farmer will therefore wait a few months to separate the oysters from each other, one at a time. This job is done with an oysterman's knife (which is also known as a separator, oyster remover, or "fisher," in France), which is a tool that looks like a large thick-bladed table knife. The rectangle jut on one side can be used like a hatchet. Farmers all have their own habits, ways of working, and knack, learned in childhood and practiced ever since. Some use only the tip of the tool, some prefer to use the lateral cutting edge, and some alternate. What is important is to get the job done.

One thing is certain: shaking the hand of an old-school oyster farmer (who works without gloves) is memorable. The hours of work in damp, cold conditions seem to have bound his fingers to the palm, turning his hand into some kind of mitt. His rough touch is explained once he bares his palms.

Cuts and scrapes, pricks, rips, and even gashes cover this thick, tough skin. It's as if we have come face to face with someone who works with brambles or barbed wire. The edges of young oyster shells are extremely sharp. Furthermore, the placement of the blades is both irregular and unpredictable. If you're not careful, you can get a cut with every move.

Making Sea Salt

Opposite: **Making salt in the Guérande, Brittany, France.**

Below: **Natural salt marsh. Ethiopia.**

Salt harvesters, or sauniers, labor in a fantastical world: a water checkerboard; a mirror covered with clouds like Asia's rice fields, except that rice fields form stairways and curving flats. The world of sea salt is strictly flat and square.

Salt is a chemical compound that is not only a tasty seasoning and a precious alchemist of food preservation, but also (and especially) an indispensable catalyst for the human body's survival. In areas where it does not exist, salt is the endpoint of faraway journeys and eons of trading. Caravans of camels heavily loaded with salt stretch out beneath the African sun. It comes as no surprise that such a universally sought-after product would be shrewdly chosen by governments as being eminently taxable. In response, French peasants of long ago would smuggle salt in hollow seats, escaping royal taxation. Gandhi's highly symbolic, poignant response to an age-old system was to lead an enormous march of an entire population toward the sea to gather its salt, reject the tax, and claim independence.

The saltmaker's work consists of taking the salt from the sea by evaporating the water with help from the sun and especially the wind. The work takes place inside large beds, square basins that are separated by low walls upon which the workers can move about. They have few tools, which are, in most cases, made by the workers themselves. The technique consists of continuously adding saltwater into the area. The water gradually evaporates, and thanks to a clever system using small boards, workers can open or close the passageway from one pool to the next. They'll push the increasingly salty liquid toward the final pool where the salt will appear in crystal form. This precious substance is then raked and piled before being brought to a refinery.

The motions are simple, consisting of raking (pushing and pulling), and of bailing.

The rake and the simoussi (a type of

long-handled screed) are both made of a rectangular board blade and a handle (the perch). On one side, the edge of the board forms a right angle and is used for pulling. The beveled side is used to push the liquid. The rake is more solid than the simoussi, and its handle is shorter. It is used for every kind of work in the basin.

The rake has a blade made of oak or elm, and its perch is made of red fir. The simoussi is made entirely of fir.

The baguette is a wooden hollow shovel comparable to a bailer, except that it has a long handle. It is used for cleaning off the liquid mud. It is made of elm, while its handle is fir.

The souvron, a type of strainer, is composed of a board and long handle that meet to form an acute angle; it is held in place by a sturdy wooden slat. There are about fifteen holes drilled into the board through which water flows when the workers bring the salt onto a flat area.

Because salt stings, the equipment of a saltmaker will also include boots and sometimes gloves. A hat is often worn because of exposure to the sun.

Obviously, the tools are never made of metal. The salt would corrode the metal, and the rust would taint the salt.

Making salt in Indonesia on the island of Sumbawa.

TEXTILES

Mangle, or Flax Crusher

The yarn or thread used by a weaver, no matter what kind, has come a long way from its beginnings. For the raw material to become what is wound in the loom's shuttle, it must undergo several steps and pass through many hands.

Coarse, smelly balls of yak and camel hair; stretchy, strong horsehair; tangled sheep fleece; delicate web-like creations from a silkworm's cocoon—these are but some examples of the natural fibers procured from the animal kingdom.

Opposite: **Another method—crushing flax in Hungary, 1933.**

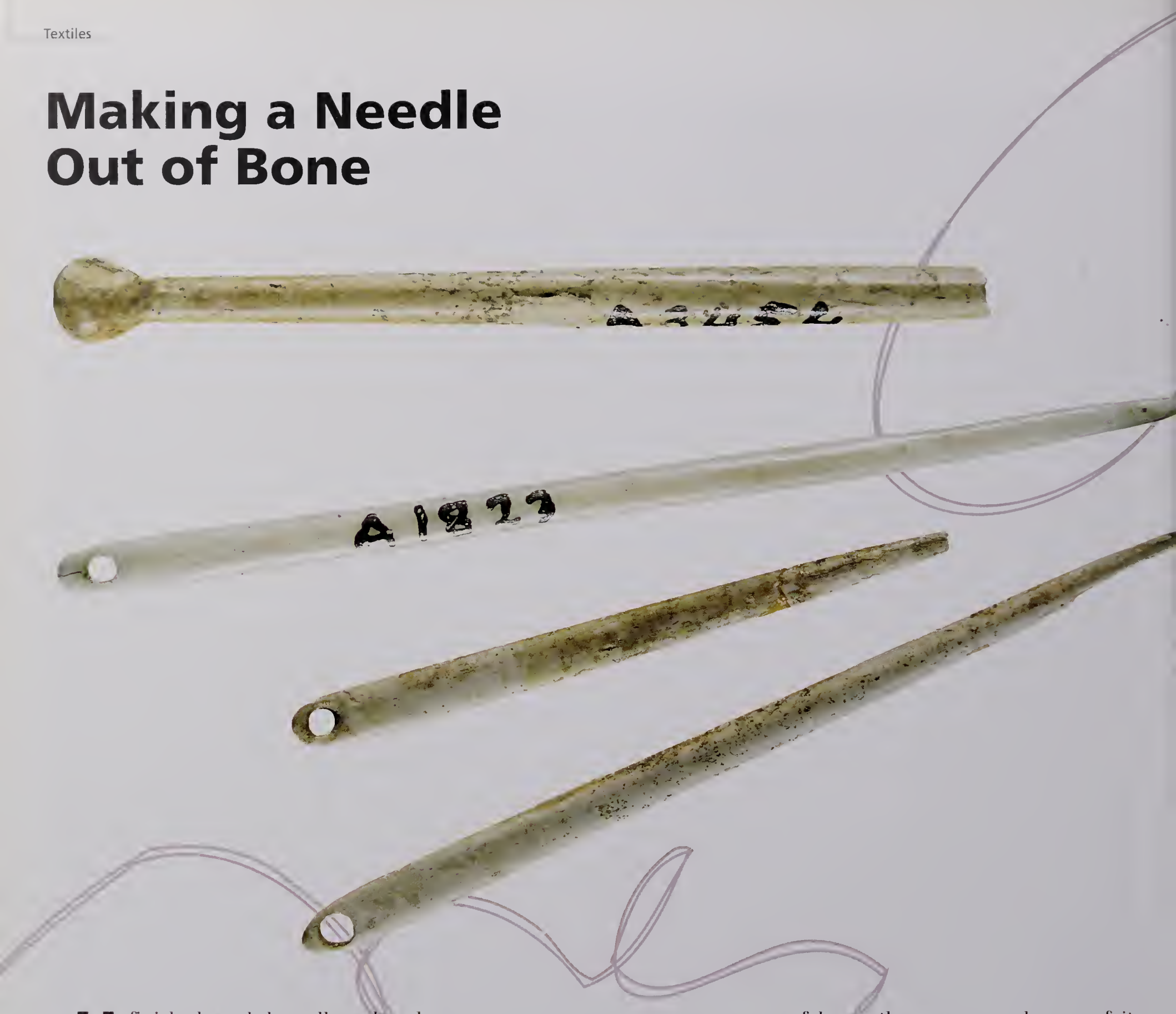
Plants, too, can be used to make fabric—bark can be beaten, and tufts of cotton can be harvested, as can long fibers from Mexican agavé leaves, flax stems, hemp, and even European nettles. The process consists of striking the stalks in a motion akin to chopping, except that a tool without a cutting edge is used.

Once again, we encounter two methods; we could even say that there are two schools. On the one hand, for better results—and if it's a part of their tradition—artisans or farmers will use a mangle, which is a wooden trestle supported by two legs shaped like upside-down Vs. A mangle has a movable beam that is raised and lowered with a handle. Wooden notches at one end of the beam will fit into two or three slots in the support and will be attached with a hinge acting as an axis.

The other method also involves using a stand. This one is a solid-wood rectangular block on which a bundle of stalks is laid. As the fibers are advanced with the left hand, they are struck with a tool held in the right that looks like a long, heavy, and thick wooden blade.

The movable beam of a mangle fits into the "table's" corresponding grooves.

Making a Needle Out of Bone



The invention of the needle allowed humans to go from draping fabrics to sewing them.

Unfinished work has allowed archeologists to understand the delicate procedure of making a needle from bone. It comes as no surprise that forming the eye of the needle is the step that takes the most patience and ingenuity. If the needle were to break just as the eye is being made, all the trouble that went into hewing its body would be lost, and the process would have to be started over from the beginning. Early humans would therefore begin by using the tip of a sharpened flint to bore half the needle's hole. Since the needle-to-be would not yet have been extracted from its compact mass of bone, there was no danger of it breaking at this point.

They would then use their stone tool to trace the outline of the needle, leaving it thick enough to ensure that the needle would be solid; the time to cut and refine it will come later. The artisan would remove the bone around this outline with a rasp or blade. Soon a stick would appear in bas-relief, emerging from the bone's surface. After further filing, the artisan would disengage the needle completely.

Because the needle's future head would still be quite large, it wouldn't be too risky to

drill the other side of the eye in the same way as the first. This work required a good amount of strength, and it helped to use the mass of bone for support.

The object would now be more delicate; it would start to be fragile. Nevertheless, the needle would need to be thinned and given a point, and the work would proceed gently and slowly. Lightly, carefully, the artisan would wear down the needle on a smooth stone, known as the polishing stick, until a perfect balance between finesse and solidity was obtained.

The way in which this tiny tool is made provides a good lesson in technique, patience, and persistence. And the invention of the object itself fills us with wonder.

The rewards and astonishing results of the development of sewing were to be immediate. Clothing was made, and large shelters were built on tree-branch frames using animal hides that had been stitched together. Then would come goatskin buckets, bags, moccasins, welts, and twisted cord.

The invention of the needle's eye opened the way for other uses of drilling, including body ornamenting. The thin sections of reindeer scapula decorated with images of the heads of wild horses might have been used as jewelry in the Stone Age Magdalenian culture of the French Pyrenees, where several were found. Their hole may have allowed people to wear them from a strap, as a pendant. Certain feather ornaments of contemporary Amazon Indians, like the Inca coat of feathers, are flexible because they are sewn on a weaving frame.

Brazilian Indian guides traditionally request needles, as well as other precious objects, in exchange for their assistance.

Shears

One thing we are certain about is that shears already existed in the age of antiquity. Several archeological museums have examples dating back to the time of the Romans.

The size of the tool, the finish of the blades, and the distance between the blades will vary depending on their use, but the basic design of two overlapping blades will always remain the same. Just like our modern-day scissors, the rounded extension of each blade allows the tool to be held in one hand, with four fingers on one side and the thumb on the other. The V shape of the blade is maintained by a semicircular metal band acting as a spring. The hand closes, squeezing the two blades in order to cut, and opens to allow the spring to pop the blades back open.

Shears are among the tools we could call self-explanatory. Anyone who holds one will immediately understand how and for what they are used.

The largest shears were used to fleece sheep; others, medium-sized and more precise, were used for fabric and leather. Very small shears could be employed for delicate work, like shaving velvet or fleecing the wool around a sheep's eyes. Today, in Japan, the tool is widely used to cut paper, and a taller version has been invented to cut garden grass.

Shearing sheep in Scotland.

Scissors for Shearing Sheep

These three pairs of scissors date back to the nineteenth century and come from northern Portugal. A peasant (or shepherd) would have been able to order such scissors from the village blacksmith, choosing from the different models offered. With these tools, as with anything, there are particularities, habits, and even unwavering loyalty to one kind of object ("I've always used these." . . . "The others hurt my hands." . . . "Those tire me out." . . . "I don't know how you could even hold these." . . . "Well, this pair constantly needs to be sharpened.").

These three pairs of scissors are all heavy and solid, which means they had to be handled by men with a strong grip. Two of these pairs have blades on the same plane and cut the wool where the blades meet. The blades of the third pair—one flat, one twisted—each work in their own way. The wool fibers aren't cut only when and where the blades meet; and they don't slip into the space between the cutting edges. Rather, the twisted blade literally scrapes the wool against the surface of the flat one.

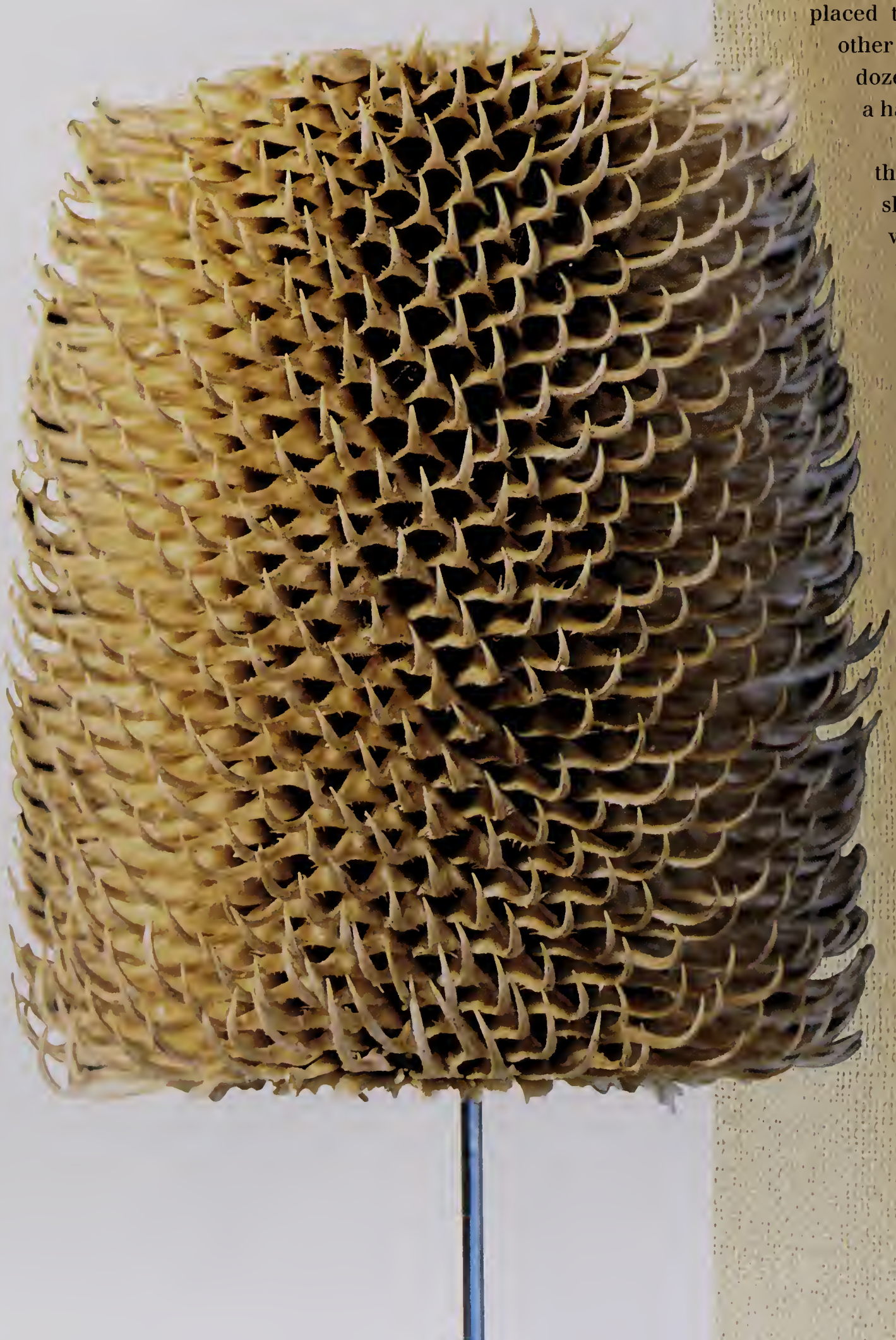
The "rings" through which these scissors are operated differ greatly. Some allow only enough room for the thumb and index finger; others for the thumb and two fingers. A strip of protective cloth was wrapped around the metal here.

These tools don't have the polish that comes through use, but rather they bear the mark of abandonment; rust has seriously deteriorated the metal. But the blacksmith's elementary, spare forms have granted the tools great symbolic value.

Portuguese sheep-shearing scissors come in different shapes.

Teasing

The fuller's teasel flower head is a tool borrowed from nature.



In the Greek countryside, there grows a wildflower, bristling with thorns. It is the fuller's teasel. The plant can be converted: both ends are lopped off and a spike is placed through the central axis. In other words, this dried plant, with dozens of flower heads, is given a handle.

"What does it do?" we ask the Cretan villager. He then shows us how the teasel cards wool fabric—raises a nap—by teasing the surface of the material.

When asked, the man said the object had to be as old as wool weaving itself. As for his created tool, it's doubtful that it came from very far away, since one can easily find wool caught in teasels by the side of the road after a herd of sheep has passed.

Depending on how it is to be used, and depending on the surface to be teased, a single plant can be fixed on a simple stick (as it is in Crete), or several can be arranged on a wood frame like a chandelier, as is done in Colombia, where teasels are used on blankets and ponchos.

Picking and Carding

Two small boards with handles, bristling with fine metal teeth.

The word *carding* designates several operations accomplished with different tools. Some pertain to the production of fabric from fiber; others renew the softness and resiliency of a mattress or chair.

For a long time, country folk slept on straw-filled mattresses that were laid on a bed frame and filled with dried local plants (seaweed along the ocean, corn husks and straw inland). Stuffing mattresses with hair and wool was an important innovation, marking great strides made in the name of comfort. Refinement of the technique included piling two mattresses one on top of the other, as is done in some Italian farms today—one is stuffed with wool for winter, and the other is filled with hair, which since it can breathe is cooler for summer.

Woman carding in Arvieux, Hautes-Alpes, France.

Because the weight of a sleeping body would pack the stuffing, it would be necessary to periodically fluff the mattresses, no matter what kind of stuffing was used. The contents of the mattress were placed in small tufts between two wooden boards that were lined with a great number of fine metal teeth. The boards, or cards, pulled away from each other. The tangled, knotted, and compressed horsehair and curling sheep wool would be separated, forming light, fluffy clouds.

Later, mattress workers simplified their task by developing a picker: two rakes lined with rows of metal teeth facing opposite directions coming together and combating each other. One is concave and remains still, and the other is convex, hangs from a frame, and is maneuvered like a swing. The teased fiber is gathered from each end of the resulting woolen arc.

Carding Arc

JORDAN

As a mattress is used, the wool in its thick canvas jacket will eventually compress. When the mattress is no softer than a mat rolled out on a board, it's time to send for someone specializing in the art of carding. The carder is called and arrives carrying a large arc over his shoulder, a mallet in his hand, and scissors and other sewing accessories in his pocket. He drags the mattress outside, and quickly opens one side. He then plunges his hand through the slit, removing the contents, and fluffing them before him.

He is now ready to begin. The neighborhood children are captivated, left speechless and delighted. The worker brings the compacted wool to the arc's cord, which is made of sheep intestine and is attached to the ends of the arc, and with a clean stroke of his bat, makes the cord vibrate. Little by little, as dust particles glisten in the sun, the clumps of wool turn

Above: **Suspended carding arc as depicted by an Indo-Persian miniaturist in the nineteenth century. From *Trades and Professions of Kashmir.***

Left: **The carding arc and its vibrating cord, which is made of sheep intestine.**

into downy, weightless flocks, light beige and brown. Once the job is complete, he stuffs this light mass back into the canvas jacket using the strength of his wrist, and then he quickly and securely sews up the outside before being paid and moving on to the next customer.

(Not everyone is as curious about the work of this traveling artisan, and not everyone has a mattress. For example, once, in a bus in India, I asked my neighbor about such an object carried over a man's shoulder. Worried about losing face, my stumped companion creatively hastened to describe the art of a singer and his harp.)

One has to be careful in asking such questions; sometimes you've got to ask them more than once to get a solid answer.

Fork for Tamping Wool

IRAN

This rather heavy wrought-iron tool relies more on its weight than the strength with which it is worked. It is used to flatten horizontally woven wool thread in a vertically oriented rug loom. It works best when regular strokes are applied.

This kind of tool was often used by young children, mostly girls. The forks were equipped with metal rings that would jangle to help the child maintain a good working rhythm. (The one below has an iron band instead.) The incentive to keep the rhythm —the cadence—of the work steady is obvious. A slow or clumsy worker would not be able to hide.

With each blow of this fork, the metal band clangs.

THE TAILOR

Giovanni Battista Moroni.
Sixteenth century. National Gallery, London

You walk by the tailor's shop. Inside there's a man with a tape measure around his neck and a ball of pins at his wrist, buzzing around his customer-turned-statue. He measures the customer's height, width, and circumference. He will then show him different patterns, helping him sort out the muddle of choices. There will be the cut, the sewing of the clothing, the fitting sessions, and the final ironing before the item is delivered.

The customer thinks the tailor's job is easy —that the task is simply to make a roughly identical copy of the last creation. This is not the case. To execute his art, the tailor must examine everything rigorously and subtly, without a word, inside and out. He must consider what might be corrected and improved from the previous item's fabric choice, style, and cut, and will assume that his client would like to appear ever more slender and svelte. He will even notice the slight unevenness in his customer's shoulders. He will fashion and sculpt the envelope of fabric (that supple, elusive material) around the actual body, erasing his customer's imperfections and embellishing his strengths. The dressed man will leave with a self-image he is pleased with. All this is done without a word from the tailor.

The example of the tailor is not unique. Artisans will not just attack their medium, tools in hand. Instead, they seek to meet the desires of others, even if they are unexpressed, and will do so with finesse.

Tailor's Scissors

The size and weight of these seissors let us imagine immediately that this tool would be used to cut tough materials, like leather, or—why not?—even sheets of metal. This is not the ease. Actually, these right-hand seissors (the thumb will be on one side, three fingers on the other, with the index finger pressing down on the bean-shaped handle) are used by tailors, especially to eut a shirt's preeious silk while following a pattern. We are quite a distance from those tiny embroidery seissors and the seissors dressmakers use. With these seissors, the blade will eut along a long, perfeetly straight line once the fabric is properly stretehed out. The weight of the tool stabilizes it, and thus any false movement that would waste some of the valuable eloth ean be avoided. The tool's key element, that which ensures its proper use, is the metal stub attaehed to the finger rings. Its rectangular surfaee rests on top of the material being cut. One doesn't lift these seissors to eut with them. Instead, they are pushed along the table resting on this stub; the stub acts like the pad provided by the pinkie when one writes or draws a line—it supports the rest of the hand. The proportions of this eomparison are also similar.

Overleaf: **An eighteenth-century Mexican painter depicted this scene in a tailor's shop. Museo de America. Madrid, Spain.**

The length and weight of the scissors ensure a straight cut.

Opposite: **Using a familiar gesture, a French tailor cuts thread with his teeth.**

Danish calender, Island of Fyn, 1805.

Calender

Our ancestors had all the tools necessary for curling hair or wigs, arranging coiffures, pleating ruffs, or ironing linens. Their tools were simply slower and more difficult to maneuver than their descendants, which we employ.

Whether they were portraying the feast of the gods, the wedding at Cana, the Last Supper, the dinner at Emmaus, or another celebration, painters of long ago took great care to depict the tablecloth's grid of creases. These were genuine and carefully observed details, the marks of a calender. This rectangular board with a handle rising from the center of one end was used to press folded linens. It was wrapped around a wooden cylinder and rolled from front to back, and from back to front. The tablecloth was then put away in the closet or laid out on the table, depending on what was needed.

Like many household objects (platters, plates, pots, butter dishes), calenders were often marked with the name of their owner, dated, and adorned with sculpted decorative motifs, or painted in bright colors. These masterpieces of popular art were common in eighteenth- and nineteenth-century Europe, especially in the north. The handles of Scandinavian calenders, decorated with charming small horses, would eventually be displayed in museums.

Ember Tongs

These tongs are easily recognizable. Their long handles will keep one's hand away from the fire; the flat, light arms make it possible to carefully lift a piece of burning charcoal.

Ember tongs were the constant companion of ironers of long ago, who would need to fish for the burning embers in a stove or brazier to fill the hollow belly of the iron.

These tools weren't found only in conjunction with ironing tables, however. They would also stand next to the chimney along with other fireplace tools, like hearth tongs, ash shovels, and two-handled bellows (or wooden or iron tubes one would blow into directly). With these tongs, embers could be held to light cigarettes, pipes, or a portable stove or brazier.

Iron

The iron is a simple plate with a handle.

Before electricity, the most basic iron consisted of a thick (to retain heat), flat iron base shaped like a pointed rib to which a metal handle was attached. Other irons were hollow and could hold either embers or a heated flat iron bar.

Ironing sheets, clothes, and, perhaps, pleats would be done on a flat surface. For delicate tasks (a child's or woman's bonnet, a lace collar, a starched headdress), irons shaped for the particular job at hand could be employed. They all had the same basic design—as if they were part of the same family—thin iron bodies about a foot in length with light wooden handles; on one end there would be a small iron piece, spherical, oval, or another shape.

The traditional Chinese iron looks like a bronze saucepan with a smooth bottom. It is filled with embers.

Ember tongs were indispensable to ironers in the past.

Irons that had a compartment for embers would save a lot of time.

Needle for Repairing Nets

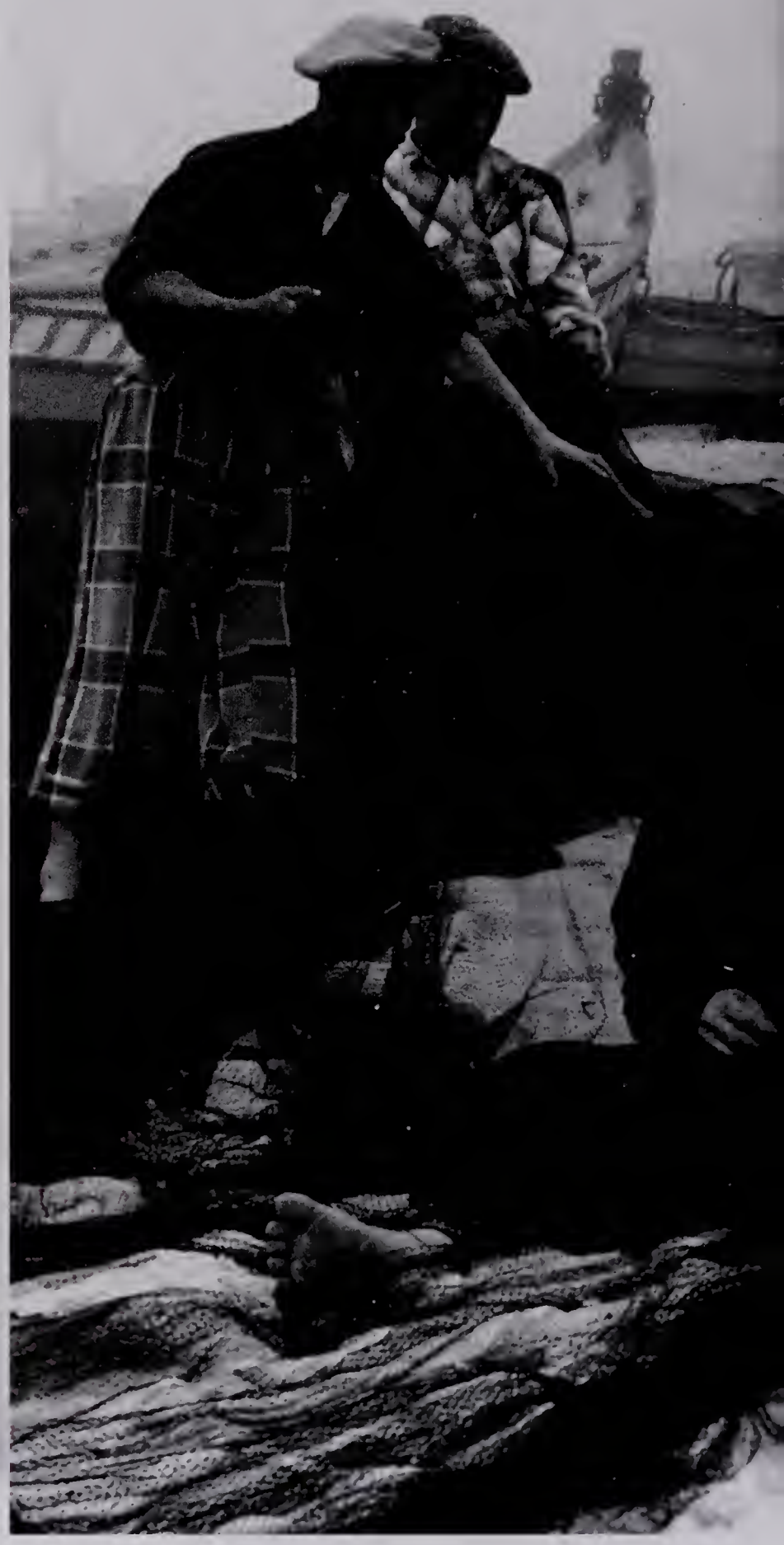
In the world of work and in the work for the world, there is always something hidden. Someone who passes by or visits a fishing port will see the boats leaving in the evening, and perhaps will see the boats docking the next morning; maybe the visitor will even go to the fish market where the night's catch is sold. But the constant and essential maintenance of fishing equipment —repairing the nets—is not necessarily as easily noticed.

Despite their strength, fishing nets can get caught on a rock, or rip or rub on the seafloor; the salt can cause deterioration; the threads can wear out from being dragged on the planks or rubbed on the winch's stave when pulled up on deck. The nets therefore need to be repaired, and this is the job for fishermen and their friends and relatives in the morning and afternoon.

From Brittany to Portugal, from Spain to Morocco, and from Greece to Turkey, fishermen can be seen, sitting and completing the necessary meshwork with the same repairing needle. The open part in the center holds a reserve of thread; and the fisherman's indispensable pocketknife will split the "line" or rope right above the knot that blocks it.

After a rough night at sea, the damage might be so extensive that several workers will be required to repair the net laid out on the docks.

Oddly enough, the fisherman's tool resembles a fish in shape.



Far right: Portuguese fishermen repairing their nets along the ocean.

Splicer

This tool is equivalent to, but bigger than, the awl that can always be found on a sailor's or fisherman's knife. It is used to splice together ropes by separating the strands that form them so that they can then be interwoven. Using this tool, a sailor can create a loop at the end of a rope for mooring a ship. Because of its smoothness and shape, it can slide through the strands of the twisted rope, making room for new strands before it is removed.

Rope is not knotted, and it tends to wear out, which is why there was always splicing work for ship crews of the past. It was common to find bored racks at the foot of masts in which splicers were stored, at the ready.

Goethe noted that the roping of the English royal ships had one unique feature: red thread would run from one end to the other. This would act not only as a sign of ownership but also as a way to spot a wreck.

The splicer, which has a revealing shape if there ever was one, separates the strands of a rope.

Tapa Beetle

OCEANIA

Tapa is the name for the large pieces of thin bark that Pacific Islanders would prepare as a canvas for wall paintings made to decorate their homes.

They remove the rough bark exterior from the tree and unroll the "skin" from around the trunk. The surface of this material is beaten with hard wooden tools called beetles, which are covered with hatched grooves. Beetles are used to smash—without cutting—the crossed fibers of this plant "fabric." Some, which have a rounded handle and a striking surface, can be used on only one side. Others have a more sophisticated square cut and therefore have four sides with which to strike. Each has different groove and hatching patterns to meet various needs. Even the most modest of tools have dignity: some Oceanic beetles are elegantly decorated with carvings.

The resulting sheets of bark fabric—they are very similar to thin parchment or a new kind of paper—are supple and reminiscent of our modern nonwoven fabrics. They are decorated with brown plant juice in geometric patterns. The sun's circle often appears.

Wooden tapa beetle *(iki),*
Marquesas Islands, Polynesia.

Elsewhere, Brazilian Indians (who use similar beetles and mallets) produce a fabric with a rough, coarse surface that is not as even. The diagonal mesh of fibers as well as the suppleness of the surface when examined up close are reminiscent of a natural weave.

In constant search of progress, humans are wonderful observers, always on the lookout for something new.

Beating bark in the Solomon Islands.

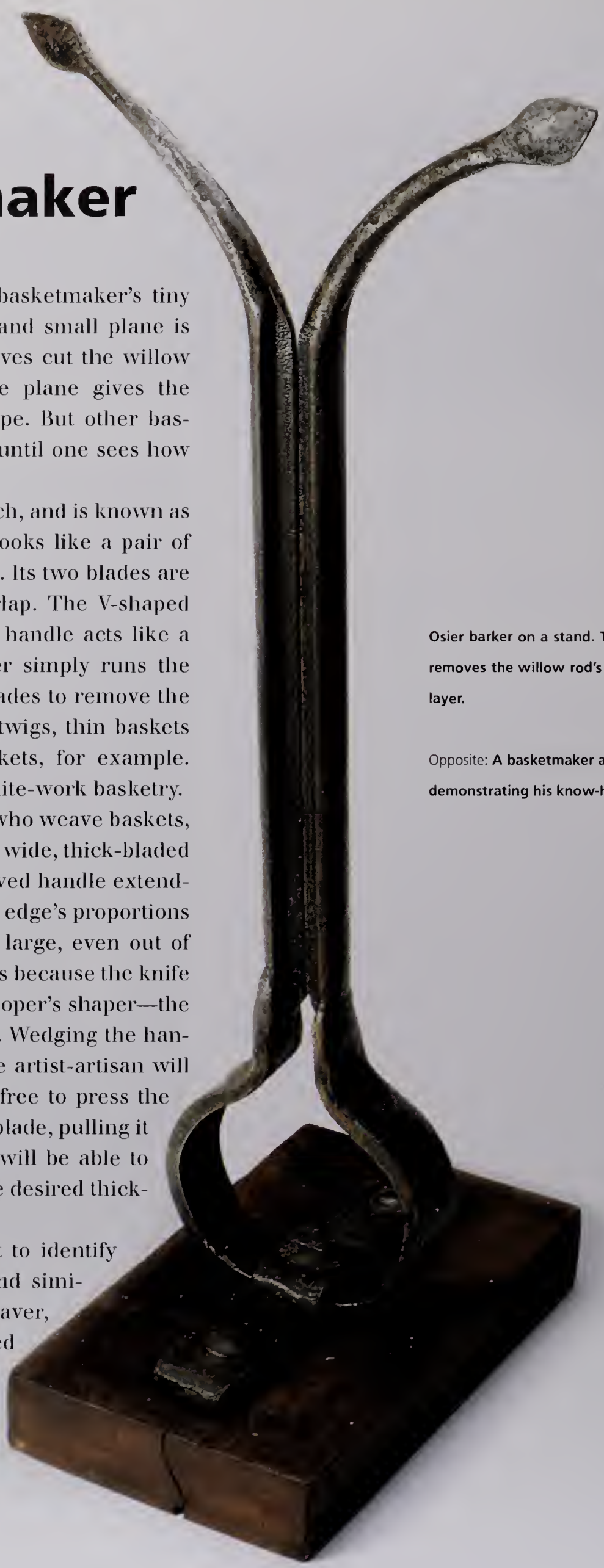
Basketmaker

The function of a basketmaker's tiny trimming knives and small plane is easy to imagine: the knives cut the willow rods, or osiers, and the plane gives the stalks a rectangular shape. But other basketry tools are puzzling until one sees how they are used.

One such tool is French, and is known as a barker. From afar, it looks like a pair of shears with rounded tips. Its two blades are parallel but do not overlap. The V-shaped metal at one end of the handle acts like a spring. The basketmaker simply runs the twig between the two blades to remove the bark. With high-quality twigs, thin baskets can be made—workbaskets, for example. This is also known as white-work basketry.

In Thailand, women who weave baskets, hoop nets, and bins use a wide, thick-bladed knife that has a long curved handle extending the cutting edge. The edge's proportions seem disproportionately large, even out of place for such use. This is because the knife is used a little like the cooper's shaper—the blade remains immobile. Wedging the handle beneath her arm, the artist-artisan will have both of her hands free to press the twig into one side of the blade, pulling it on the other. Thus, she will be able to cut twigs and strips to the desired thickness and width.

It is the mind's habit to identify things by comparison and similarity. This twin of a cleaver, these false shears are used to prepare the elements for a basket.



Osier barker on a stand. This tool removes the willow rod's outer layer.

Opposite: **A basketmaker at work, demonstrating his know-how.**

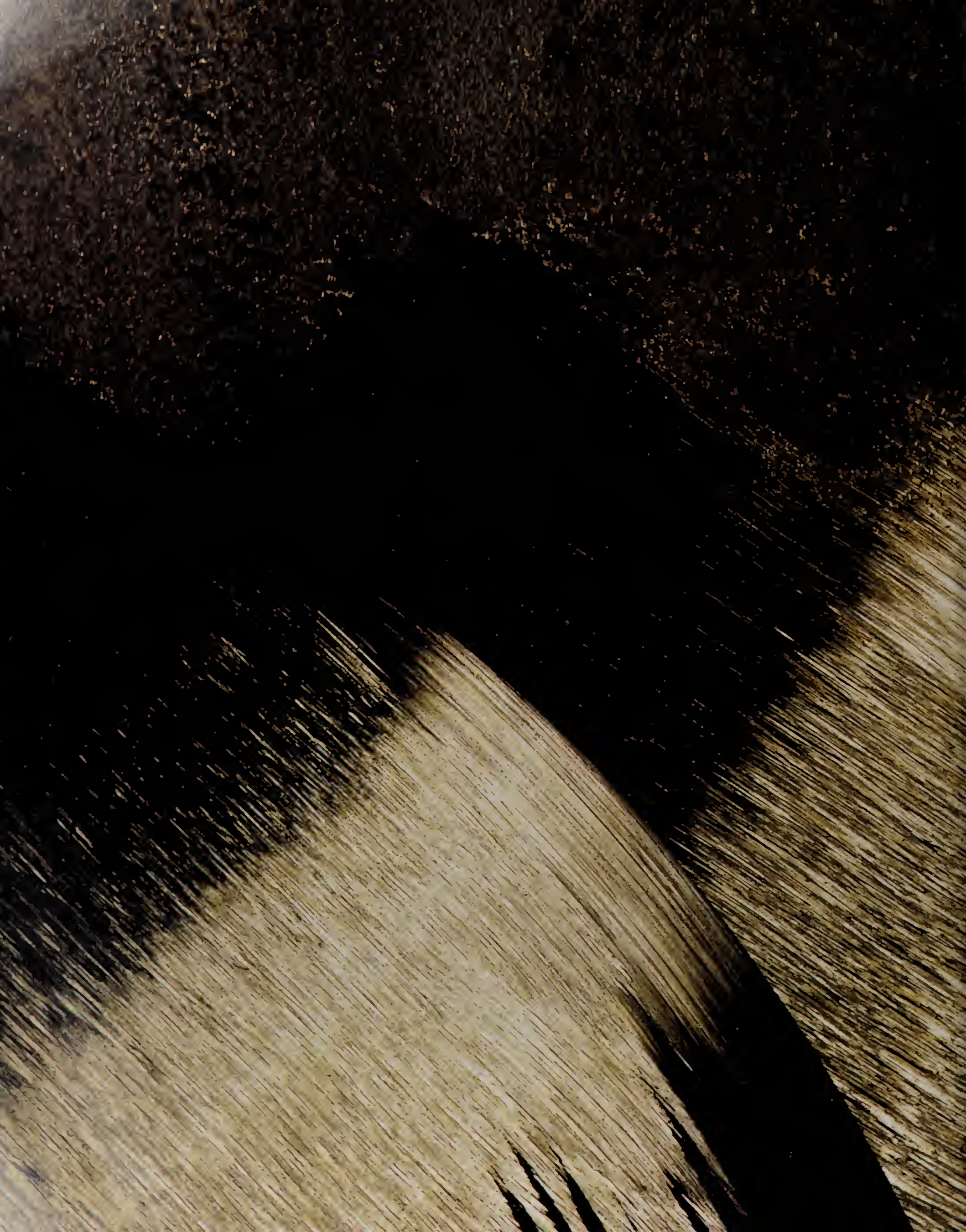
Basketmaker's Cane Splitter, or Wedge

This simple tool, an ingenious invention, is skillfully carved by the artisan's knife, but is unknown to industry and commerce. A basketmaker makes an incision at the base of a willow twig with a knife, dividing it in three. The three edges of the splitter are lined up at the incision and are driven through to the twig's other usable end.

One might wonder why the tool is not made of metal. The reason is simple: the metal might cut the stalk, causing the splitter to go off course and not split the whole stalk in three. However, with wood against wood, the block gently follows the thread of the twig and its veins. Thus the osier is used to its fullest.

The material with which a tool is made will affect how it is used.

Left: **The artisan's hand pushing a cane splitter (also below).**



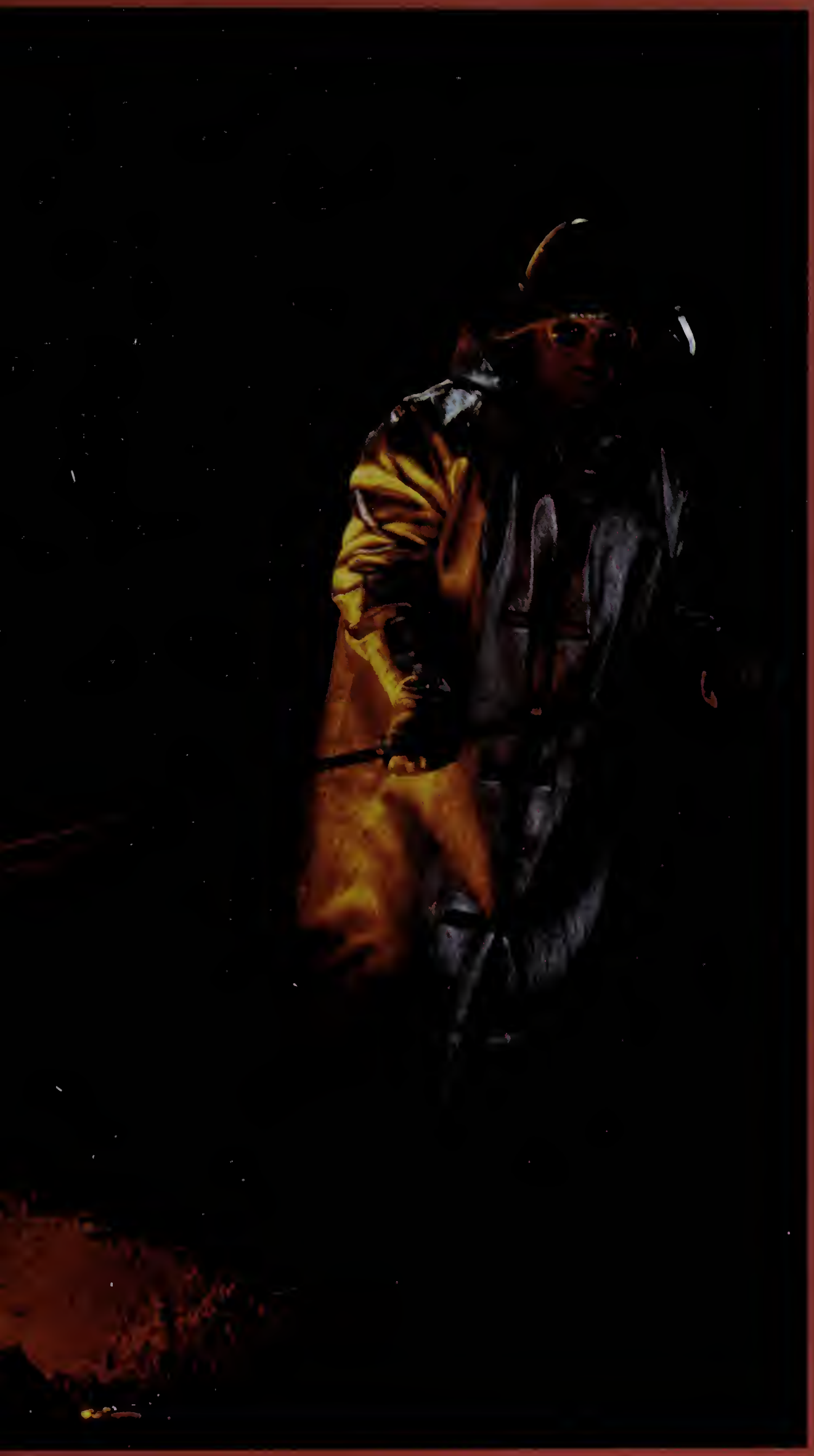
METAL

Foundry Ladle

This is a ladle, or to be more precise, an iron ladle with a spout on the side and a very long handle to make sure that the founder's hands can be a safe distance from the heat of the liquid metal. The tool is an indispensable intermediary between the crucible in which the metal—copper, lead, tin, silver, gold, and so on—is melted and the mold into which it will be poured. Obviously, this large ladle also has to be fiery hot to keep the metal from falling below the temperature needed to assure best flow characteristics. The tool varies immensely in size, ranging from the heavy ingot ladle used in a foundry to the medium-size example used by bronze sculptors in India to the African jeweler's tiny ladle.

The large ladle is used to draw molten metal from the crucible on the fire stoked by the bellows. The smaller version plays the double role of a crucible held over the fire and a pouring tool.

A metalworker pours molten metal.



ODYSSEUS VS. THE CYCLOPS

"When the wood, green though it was, was about to blaze, I drew it out of the fire glowing with heat, and my men gathered around me, for heaven had filled their hearts with courage. We drove the sharp end of the beam into the monster's eye, and bearing upon it with all my weight I kept turning it round and round as though I were boring a hole in a ship's plank with an auger, which two men with a wheel and strap can keep on turning as long as they choose. Even thus did we bore the red hot beam into his eye, till the boiling blood bubbled all over it as we worked it round and round, so that the steam from the burning eyeball scalded his eyelids and eyebrows, and the roots of the eye sputtered in the fire. As a blacksmith plunges an ax or hatchet into cold water to temper it—for it is this that gives strength to the iron—and it makes a great hiss as he does so, even thus did the Cyclops's eye hiss round the beam of the olive wood, and his hideous yells made the cave ring again."

The Odyssey
(translated by Samuel Butler)

It is worth noting that when Homer describes Odysseus's struggle with the fearsome Cyclops, the poet uses two comparisons from the world of work and tools. That is perfectly natural. We can easily imagine Odysseus as a naval carpenter repairing his vessel after a storm at sea, or as a blacksmith constantly needing to retemper his ax blades. These images are very vivid for the listeners to or readers of the epic poem: Who hasn't seen such artisans at work at the docks or on the narrow streets of the many ports of the Greek islands? And the dramatic effect is successful: To save their lives, the navigator and his companions, overcoming hatred, cruelty and the horrifying spectacle of want are mainly concerned with surviving, and toil methodically, like indifferent day workers

Forge

I admire the farrier (the person who shoes horses) for the series of tasks that starts with taking a bar of raw iron and ends with nailing in the shoe tailored to the hoof of a living animal. I am amazed by the breadth of the necessary skills and abilities.

There are two ways to describe that talent so that other people can imagine it. We can draw up a list of the various shapes the farrier can make. We can also try to become aware of the farrier's talent from the outside, to view it synthetically, and, to explain it better, to compare it to an activity belonging to an entirely different sphere.

The two approaches complement each other, the second being more brilliant.

I'm referring to the American artist Alexander Calder, the creator of mobiles, stabiles, toys, objects, instruments, utensils, and statues made of iron, tinned iron, and iron wire. He is the farrier's cousin, perhaps without knowing it. Both of them are artists in metal and nothing but metal. The artisan works with polished metal, and the artist paints it, both to be consistent and joyful. They both hammer, bend, cut, and weld iron, in all forms: wire, bars, and sheets joined together—red hot—by rivets, hooks, or other fasteners.

Calder, the good-natured giant, seems to order iron around. He tells it, "I'm going to twist you into a cone, you into a sheet, I'm going to crease you, I'm going to hollow you out, I'll turn you into an oval as if you were paper, but since you are metal you'll keep this shape forever." And the visitor to an exhibition of Calder's work, or better still, to his studio, filled with works in progress and unfolding ideas, discovers the grace, light-

Heavy, patient, singing: the anvil, and its ally, the hammer.

The blacksmith in his workshop.

ness, suppleness, docility, even silkiness that the artist draws from an iron ingot, the mutest, most daunting object in the world.

If you spend a day with a blacksmith armed with this new view of things, you will see him as the master of a Noah's ark of the inanimate: iron. Everything done with this metal, for the home and the field, for traveling on land and on the sea, for war and decorative purposes, whole or in part—nails and keys, hinges and drills, tools and plowshares, chains and rings, rods and wedges, weathervanes and wall decorations, not to mention every type of material used for patching up, repair, and adjustment—comes from the metalworker's hearth, has been worked on his anvil, has felt his hammer.

Of course, the distinctions between professions often blur. The blacksmith and the farrier have many tools in common. Both of them use the hearth, the bellows, pokers, anvils, hammers, tongs, and other tools. But the blacksmith has to have special tools to form iron objects into the very specific shapes he is expected to produce.

Certain accessories or tools are employed to hold or move the pieces of iron being worked.

Faithful to its job, its base firmly planted in a piece of wood, the vise is there, up against the workbench, with its solid iron jaws and its handle running through the ring of its axis.

Ready to use, the tongs are held vertically in the loops of a kind of belt around the body of the anvil. Though the shape of their jaws may vary widely, all tongs share a general family resemblance. The reason is simple: the artisan requires them all to hold tight, to be strong, and to fit the shape of the object being held under the hammer or to

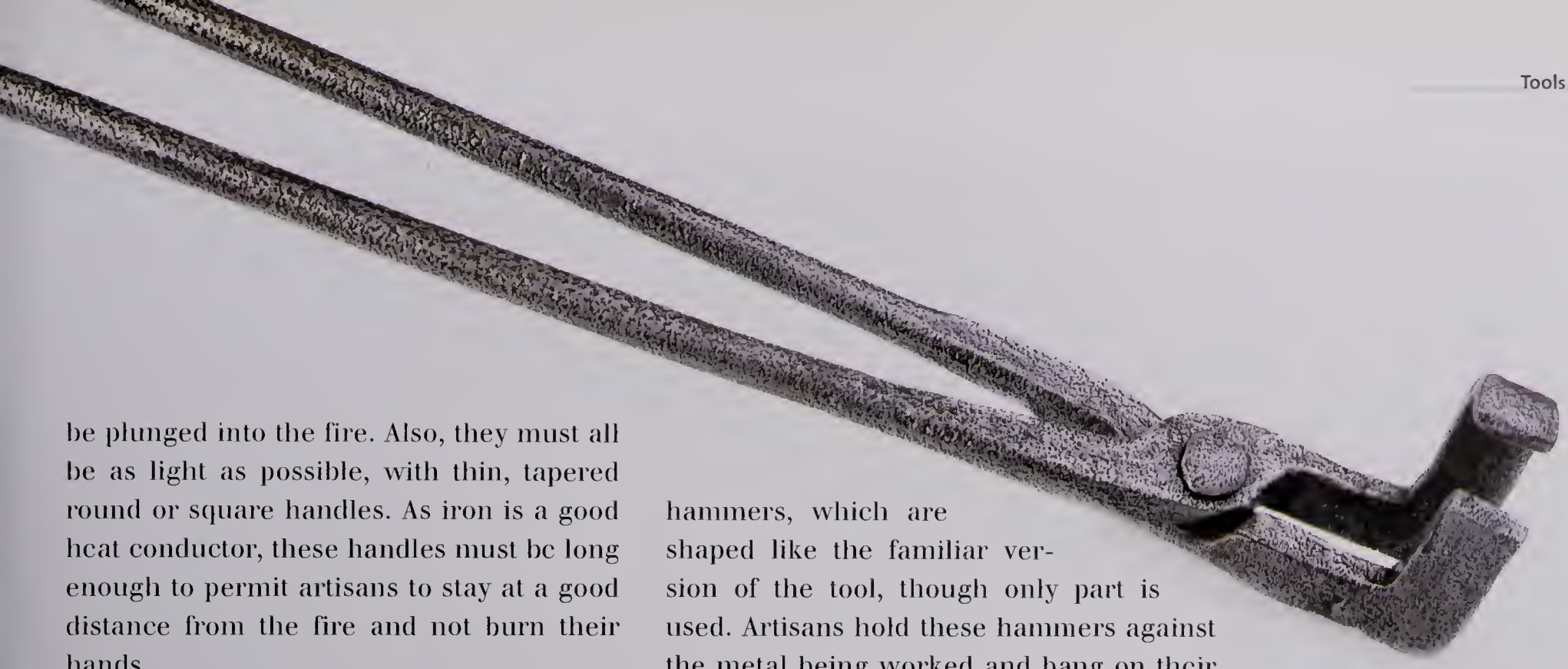
A smith is hammering in the background while his assistant operates the bellows. India.

be plunged into the fire. Also, they must all be as light as possible, with thin, tapered round or square handles. As iron is a good heat conductor, these handles must be long enough to permit artisans to stay at a good distance from the fire and not burn their hands.

Screw dies are large, two-handled iron plates with one or more holes in a flat center bulge used to thread screws. The inside of the cylindrical hole is threaded. Actually, it is a cutting bolt with two arms that locks around an iron cylinder being made into a screw.

The screw tap is used for complementary jobs. It cuts an internal thread for a bolt or for a completely different piece requiring a thread. It is shaped like a slightly conical screw with a rectangular head and is turned with a square wrench or an adjustable wrench. One of the screw tap faces is filed flush; the resulting empty space makes it easier to remove the swarf (the metal shavings).

This group of tools also includes hammers with broad, flat peens, such as scaling hammers, which are shaped like the familiar version of the tool, though only part is used. Artisans hold these hammers against the metal being worked and bang on their head with another hammer.



A tool that enables the user to maintain the metal's cylindrical shape.

Another tool with a deceptive shape is the swage block, a sort of mold for molten metal. Its two halves have the same shape, but the top swage has a vertical handle and the bottom one has a foot shaped like a comma that the smith inserts into a corresponding hole in the anvil. The metal to be worked rests on the mold, and is covered by the top swage, which is struck by a hammer.

This was the principle the ancients used to strike gold, silver, and bronze coins: the metal pieces were melted in the molds in sequence. A piece of heated metal was placed between two wedges etched with the

The shape of the tools used changes as the blacksmith's work progresses.

head and tail of the coin. The hammer struck the top surface of the upper wedge, which was then lifted, and the piece was removed. The result was genuine masterpieces of bas-relief sculpture, such as the gold coins of the Greeks in Sicily and the gold staters of the Parisii Gauls or the Bretons.

The blacksmith has a wide variety of sizes and shapes of each tool. You can find points to punch metal (barrel hoops, rims for carriage wheels), the heavy, permanently attached bench shear (to cut sheet metal), and various instruments for measuring length or thickness (square ruler, caliper gauge, calipers, outside calipers).

Long ago, people possessed many skills, and everyone had a certain know-how. Many everyday objects came from a village's immediate surroundings—the beams from the forest, the stones from the quarry, the flax and hemp from the fields, the wicker for baskets from the river, the thatch from other fields, the charcoal from the woods. And the clay for the tiles and the bricks of Bressane farms was dug so close to the house being built that you could tell how sound its construction would be by looking at its reflection in a nearby pond.

In many regions, the only things that came from the outside were the grocer's salt and the iron worked by the blacksmith. The artisan obtained rods, shafts, bars, and sheet metal from a merchant called an ironmonger. Upstream, he had worked as miner and founder.

Blacksmith at work.

Suwon, South Korea.

THE FORGE OF VULCAN

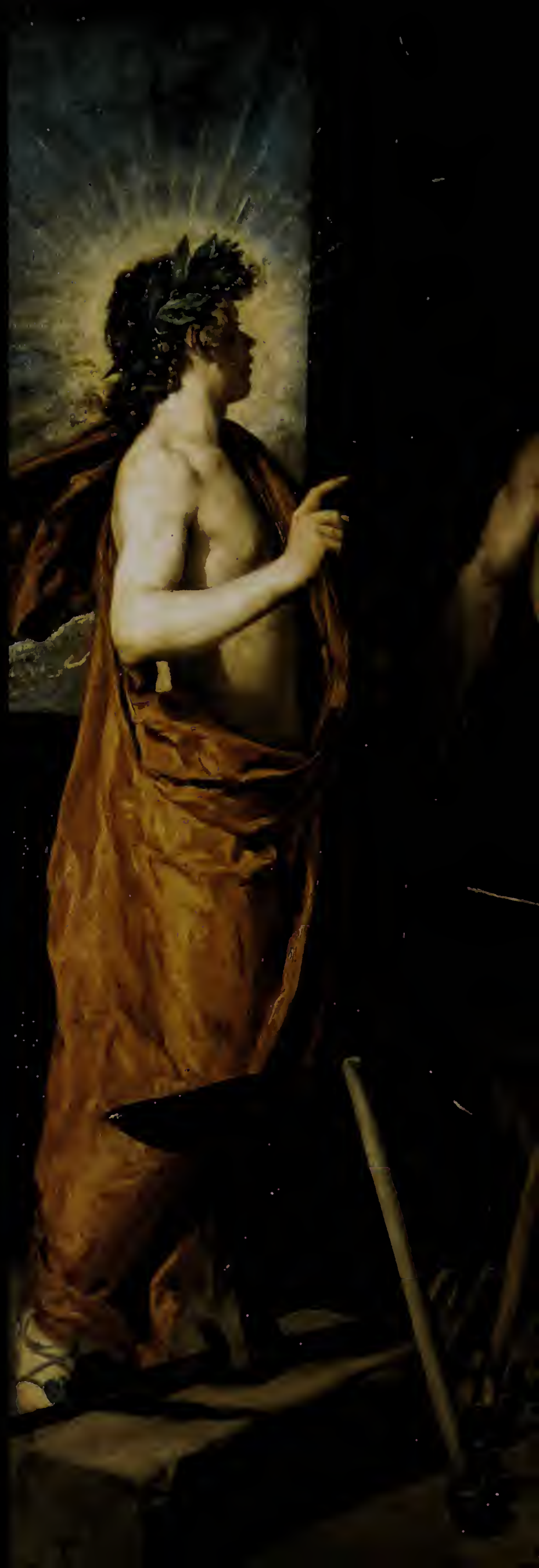
Diego Velázquez, 1630.
Museo del Prado, Madrid.

Executed during Velázquez's stay in Rome, this painting radically reworks mythological genre painting. No false antiquity here. Only Apollo, on the left, reveals his divine nature by his robe, laurel crown, and halo. Vulcan, with a handkerchief tied around his head in the Spanish fashion, is a smith among other smiths, and like them all is practically naked, thin, and parched as the result of long hours of toil spent next to the hearth. Velázquez discretely suggests the smith-god's limp by slightly shifting his hip and the way he holds his body. Along with his two assistants, Vulcan is about to strike a red-hot iron sheet with a hammer, which the artist shows us as if he were giving us a detailed description—long handle, elongated cylindrical blade, seen from above and in profile. Two other hammers with the same typical silhouette lie on the ground already poised to strike. There are two anvils, one large and massive; the other, fixed to the base of its beam, is more slender. On the right, another blacksmith is cutting a piece of sheet metal with tinner's shears on top of a breastplate. In the background, we see an assistant working the bellows: the chain is over the hearth where the fire is burning. Armor is produced here. The setting, the objects, the men's stances, and their bodies have all been seen and noted with the sense of camaraderie a painter, himself a manual laborer despite the fact that painting is a mental activity, feels with the workers who beat red-hot iron.

If you wanted to make hammers, snips, tongs, and anvils, all you would have to do is to copy the objects so faithfully reproduced here by the respectful Spanish painter.

Finally, here we have the event that stuns the rough men of the smithy. Apollo informs Vulcan that Venus has been unfaithful again, this time with Mars.

Velázquez's friend and protector, King Philip IV of Spain, bought this painting in 1634, though there is no doubt that the master repainted Vulcan's face toward the end of his life.



At the Farrier's

It's right that the farrier's shop fascinates a passerby, and it's natural that the artisan invites the visitor in to sit on a highly polished bench, up against the wall near the forge furnace. Gradually, the visitor's eyes grow accustomed to the lack of light. The farrier explains that he needs the darkness to do his work properly. The color of the iron—ranging from orange to dark red—is what tells him its temperature. Too hot, iron "burns"; too cool, it is impossible to work. The ideal temperature for hammering on the anvil is a nice dark red, easy to make out in the darkness.

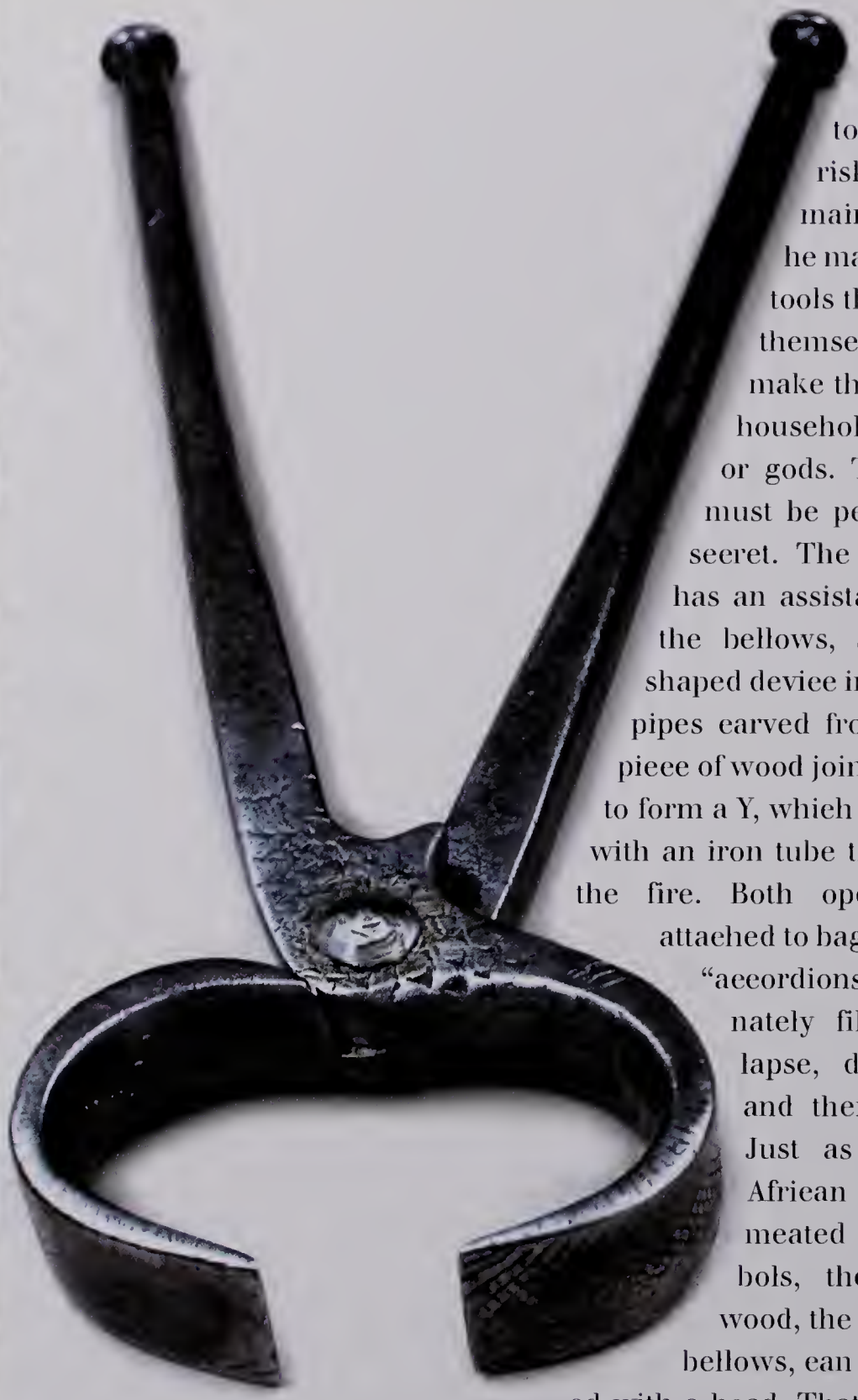
Above the forge hearth is the large leather bellows—the same shape as the ones used for fireplace fires, but much bigger—which the assistant works with a chain. It is used to stoke the fire, which must be lively but still contained, to conserve fuel. Picking up or putting down a tool, or walking from one place in his workshop to the other, the farrier quickly plunges his hand into the blackish tub filled with water and sprinkles the furnace with it. The observer is startled—does he want to put out the fire? "Oh, no," the artisan answers. "A bucket of water will put out a fire, but a handful of water gives it air, helps it to burn more brightly."

You haven't seen anything yet. Before long the iron becomes malleable. The horse shows no reaction to having the fiery iron placed on its foot, though the burning hoof gives off plenty of smoke.

In antiquity and still today in countries with rudimentary technology, for small forge jobs air is fed to the fire by mouth using a metal tube. Despite how it might seem, the result is excellent, as the main thing is to concentrate the heat on one spot.

Traditionally, the African blacksmith lives and works outside the village, due in part

The handles of the pincers are used to hold the shoe.



Horseshoe nails and the tool used to pull off the old shoe.

to the large risk of fire, but mainly because he makes the iron tools that are then themselves used to make the images of household ancestors or gods. These tasks must be performed in secret. The blacksmith has an assistant to work the bellows, a strangely shaped device in which two pipes carved from a single piece of wood join a third one to form a Y, which is extended with an iron tube that touches the fire. Both openings are attached to bags or leather "accordions" that alternately fill and collapse, drawing air and then exhaling. Just as traditional African life is permeated with symbols, the piece of wood, the heart of the bellows, can be decorated with a head. That is how the smith wins over the powers of the air to make the device work properly and better.

Now the visitor discovers the anvil on its block. A solid iron rectangle resting on four feet, with a flat top, it stands imposingly in the center of the shop. The top is elongated by two tables, "horns," one of which is conical and the other square. The steel top contains two holes in which to insert accessories. The anvil is a passive tool, complementing the smith's hand hammer. Yet it is more important than the block for the person who wields the ax (or billhook) or the butcher's block. Essentially these tools are undifferentiated fulcrums for applying force. Chopping "in the air" is a waste of precious energy. The anvil's

special silhouette and the configuration of its volume make it a multipurpose support to flatten soft iron hammered with powerful blows. Here it can be used to flatten iron plate, there to round it, and in another place to bend it at a right angle. With the help of accessories inserted into its holes, the artisan can accomplish a variety of fine tasks as well, such as cutting or punching iron.

In the olden days, the blacksmith, the eternal victor over iron and fire, was credited with healing powers. A child with an inflamed joint was held on one end of the anvil, and the artisan would set it vibrating with powerful hammer blows.

As you can imagine, an anvil has a difficult life. It can wear out and even split. You can tell this from the sound it makes when you hit it after resting its four feet on four corks. If the sound is clear, all is well, but if it is dull, the anvil will have to be recast.

The anvil does not flinch under the often-heavy blows of the farrier, the blacksmith, and their assistants. It also symbolizes the idea of unshakable resistance and unfailing tenacity. It is no accident that one of the most important military operations of World War I was named Anvil.

The farrier continues: "The next horse is Bijou, a strong Percheron. A regular. Come with me outside. . . . No, there's nothing to worry about. He is docile and not afraid of anything. With horses, you see, this is what you have to be afraid of: just imagine that the wind lifts a piece of tinfoil from the ground, and you have this huge animal who panics, forgets the roller or the plow he's pulling, and gallops to the end of the field, jumps over a hedge, and doesn't stop until he reaches a wall or some other obstacle he can't get around, out of breath.

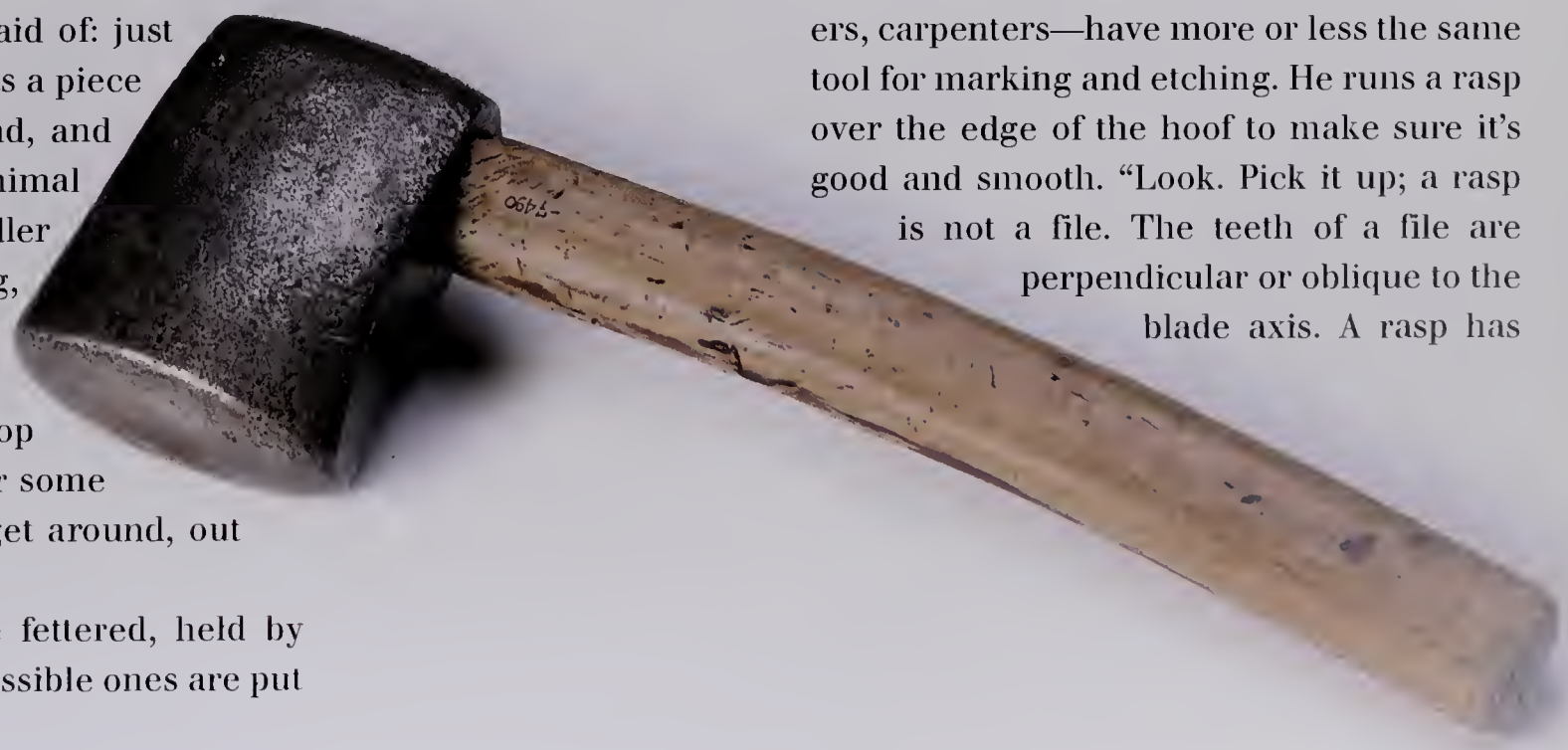
"Stubborn horses are fettered, held by the nose. The really impossible ones are put into the 'work,' a wooden cage with straps. You see, in the back of the courtyard.

"Once I know a horse's size, I put a few extra shoes very close to the fire."

The apprentice pumps the bellows.

The farrier walks from the dark into the sun. The horse's owner is there, next to his work companion, who is held to his tether by a ring. "Before shoeing, we have to take off the old shoes," the farrier says, "just like when we go to the shoe store. My customer will lift the horse's foot using this strap. My pincers, shaped like any other but with a much longer handle to ensure a better grip, enable me to remove the nails and the old shoe. The hooves have grown, so we have to trim off the excess with the frog cutter, this simple sharp flat iron blade, which you work with a mallet. Long, long ago a trimmer called a butteris was used instead; it was called that because you push it and it cuts with its tip. I still have one here, it's on the wall there as decoration, a memory of the old days. It was banned because it was judged to be too dangerous. And that is true. If in one spot, the hoof puts up a little resistance, you force it. You force it a bit more. And then—this is what usually happens—it lets go, and the blade flies into your thigh."

He finishes cleaning and preparing the bottom of the hoof with a type of curved knife he calls a rainette, or hoof knife. Members of other professions—foresters, coopers, carpenters—have more or less the same tool for marking and etching. He runs a rasp over the edge of the hoof to make sure it's good and smooth. "Look. Pick it up; a rasp is not a file. The teeth of a file are perpendicular or oblique to the blade axis. A rasp has



The farrier's hammer, where imbalance is an invitation to action.

points arranged regularly, like nails or spikes taken from the surface of the metal.

"The foot is ready. I can see by its color that the iron is the right temperature. I grab it with these straight-jaw pincers. I put the shoe in place for a second to check the fit. Now, look at this little trick. How to pull it off? My flat-nose pincers can't do it. It's very simple. I'm going to turn these pincers around, open their handles, and insert the two ends into the nail holes on the shoe. That way, I'll be able to lift the shoe by firmly grasping the tool in the middle.

"The hoof doesn't have to be made to fit the shoe; the shoe has to fit the hoof. Otherwise, the horse might limp and, sooner or later, become injured. Everyone who works with horses has to know how to observe the animals; they have to be part veterinarian.

"I have to tighten the bottom of my shoe a little. A short run through the fire. A few blows with my hammer. You've already seen that. Take it in your hand. You can feel how it's a little unbalanced in front. Most of the metal is in front. And the shoe's arms are also bent toward the front. You can tell the shoe is made to be worked on the anvil, that it's made for striking metal firmly on a horizontal surface. Try to drive a nail into a wall by hitting it with a hammer. You'll ruin the nail, and, what's more, you'll leave a big mark on the wall! It strikes, of course, but using the weight, you don't swing the tool, you don't grasp the handle tightly, you let it fall under its own weight. And that only works if you know how to do it."

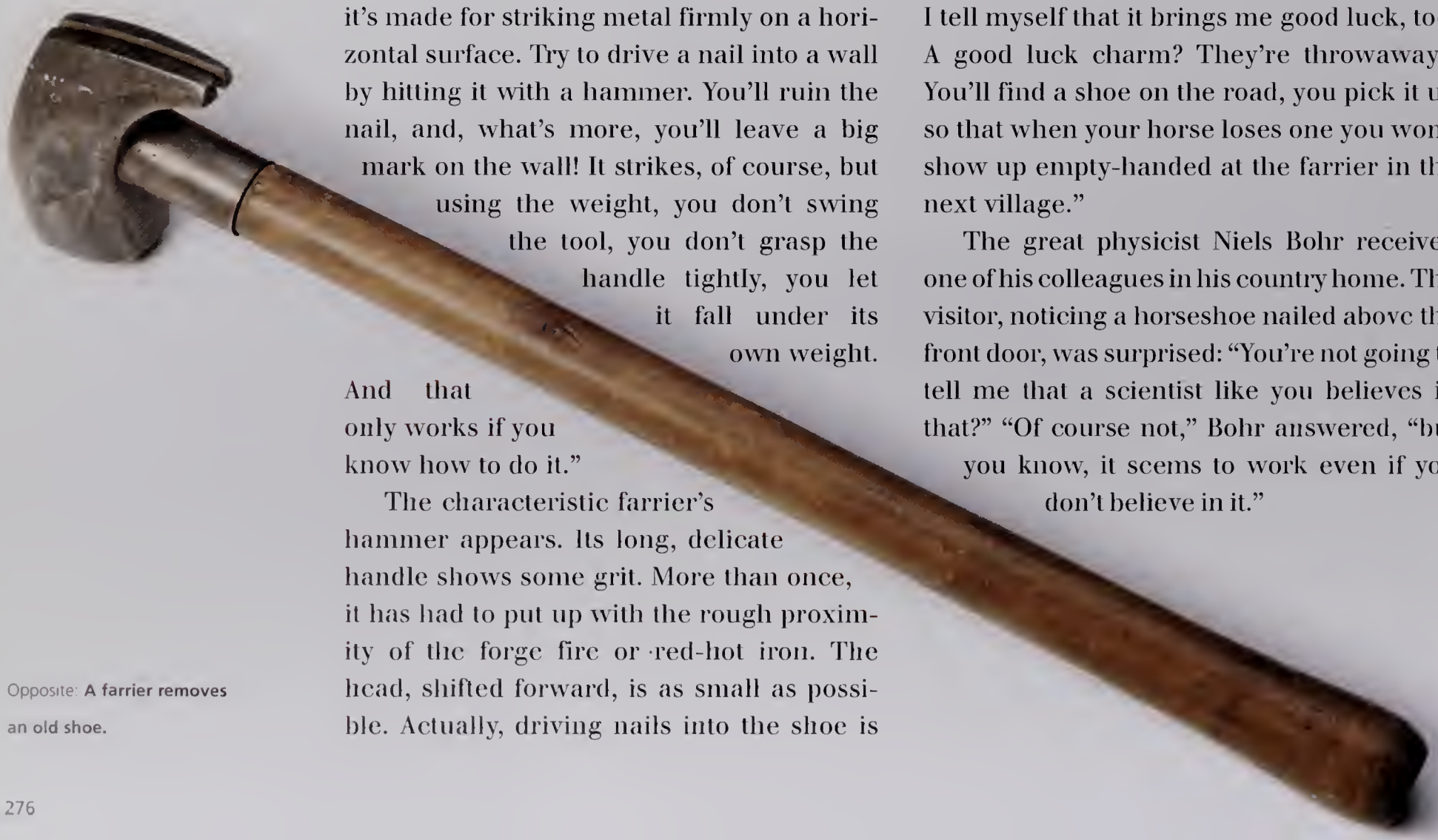
The characteristic farrier's hammer appears. Its long, delicate handle shows some grit. More than once, it has had to put up with the rough proximity of the forge fire or red-hot iron. The head, shifted forward, is as small as possible. Actually, driving nails into the shoe is careful, delicate work. The shoeing hammer does not have to drive the square nail head flush. The nail tips penetrate the side of the hoof and are cut flush with the surface using the pincers. A pass of the file eliminates any roughness and transforms the horseshoe into a real work of art.

In fact, the visitor compliments the farrier. The man invites me to have a look at the "Saint Eloi's bouquet" that adorns the building's facade. "You'll see. This is the farrier's insignia and at the same time, the history or a story about the profession. You make it, all forged by hand, when you are made a journeyman. And you hang it over your door when you set yourself up. Look at it carefully. You see all the tools in miniature, the different kinds of shoes for the horses, and for cattle, donkeys, mules; all that in a garland of iron flowers.

"I've often been asked why a horseshoe brings good luck. I've never known anything about it, and sometimes those who carry them know not much more. The old shoes are recast. Shoes made of shoes. When someone asks me to give them one to hang over their house door, I give it to them. I tell myself that it brings me good luck, too. A good luck charm? They're throwaways. You'll find a shoe on the road, you pick it up so that when your horse loses one you won't show up empty-handed at the farrier in the next village."

The great physicist Niels Bohr received one of his colleagues in his country home. The visitor, noticing a horseshoe nailed above the front door, was surprised: "You're not going to tell me that a scientist like you believes in that?" "Of course not," Bohr answered, "but you know, it seems to work even if you don't believe in it."

The elegant shoeing hammer.



Opposite: **A farrier removes an old shoe.**

THE LEGEND OF SAINT ELOI

Anonymous Catalan artist, Reredos of Saint Sebastian.
Museo de Arte de Catalunya, Barcelona.

Eloi, a consummate farrier and virtuoso in his profession, wished to make a big impression in proclaiming his qualities. So he wrote on his sign: "Eloi, farrier. Master of all." But Jesus, who sees all, took note. He appeared as a young apprentice and introduced himself to the famous master, and asked Eloi to hire him. Sure of himself and jealous of his reputation, Eloi asked the visitor what he could do. Jesus modestly replied that he knew how to forge iron and shoe horses as well as anyone else. Stung to the quick, the "master of all" held out at the end of a pair of tongs the shoe he was about to finish. What did the apprentice think of it? Calmly, Jesus said that it was good work, but surely the job could be done better. Enraged, Eloi bombarded his visitor with questions. The answers were both correct and quick in coming; it seemed the novice knew the profession as only one with experience could. Amazing! Enough talk, Eloi said, deciding that it was time to watch him at work. Eloi ordered the young man to perform a whole series of tasks requiring both strength and agility. Jesus passed them all with a magical kind of speed, as if time was different for him than it was for the rest of the world.

After all that, he must be rather tired, Eloi said to himself.

"All right, lad, shoe me the foot of the horse tied in front of the shop door."

"Fine," he responded. "But I need a leather knife."

"A leather knife? For what?"

He had already taken the cutting tool resting on a block.

"All right—to do this."

With a clean blow, he cut off the animal's leg, and then he carried it to the workbench, tightened it in the vise, and fit the shoe to the foot with the same strange speed. Then he put it back in place. And there was no trace of a cut.

It was the sort of sight that makes you doubt your own eyes. And it can drive you mad. That's in fact what happened. Eloi saw red and cried, "Me too," and grabbed the knife. The animal let out a fearful groan and collapsed into a pool of its own blood.

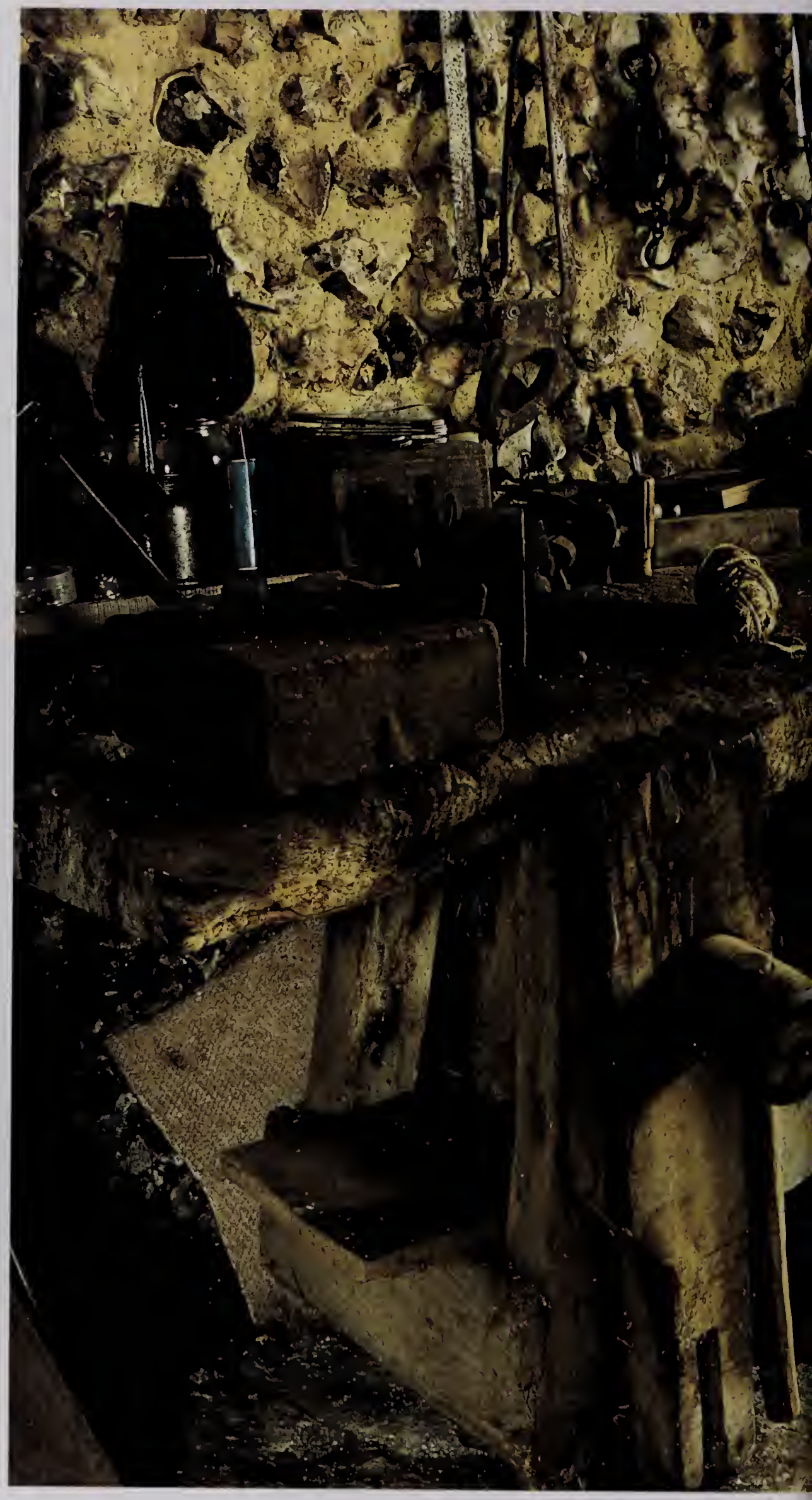
Contorted with fear, the farrier fell to his knees and cried out: "Help me, I beg of you, Jesus, my master!" Jesus replaced the foot, lifted the farrier up, and ordered him to follow him. Eloi took down the cursed sign and went out to preach the good word.

He became bishop of Noyon and Dagobert's treasurer before he was sainted. Patron saint of those who use the hammer, Saint Eloi is venerated by orphans but most of all by farriers, because of this vivid tale.

Points of Support and Work Areas

There are tools that workers have an easy time using—portable, light tools. The winegrower goes into the vineyard carrying pruning shears; the forester walks right into the timberland, billhook in hand. On the other hand, the butcher places meat on a block to debone and cut it. The blacksmith always uses an anvil to absorb the recoil from the hammer striking the piece of iron. Not to mention the cabinetmaker with a workbench, including a vise and clamps. Logs are split and branches cut on a block made of a large tree trunk set on the ground or on a smaller sawing tackle, a tripod-shaped device. Anyone who saws branches uses a sawbuck made of four pieces of wood joined to form a pair of Xs on the central axis.

While the principle behind their use is comparable, if not identical—supporting the piece on which the tool will be applied using blows or pressure—the useful life of these supporting structures varies. The anvil and the workbench last the longest. The surface of a wood block is eventually eaten into by crisscrossed blade blows. The "rustic" object has to be replaced. The butcher's block, a



The workbench and its accessories: the bench vise, the clamp, the metal vise.

dauntingly thick table with solid decorated feet with a front ring for moving it, is a special case. Its upper portion has been well constructed out of so many wood rectangles that the surface looks like a checkerboard. The purpose of this design is to better withstand wear and tear. Still, it wears out, is dinged, and loses its flat surface. There are all the knife cuts, the blows with the cleaver blade, and the bone saw scrapes, though also and most of all, going over the surface every day with the scraper can scratch the wood with particles of animal matter. As the butcher has a habit of performing the same work in the same spots, the originally flat surface of the "table" becomes a landscape of dings and bumps. The work suffers as a result. To solve the problem, the heavy piece of furniture can be turned upside down, so the bottom becomes the top. The thickness of the wood and the mosaic layout of the hardest heartwood pieces are the reserves. Sooner or later, though, these pieces of parquet will have to be refinished to create a new flat surface.

According to an old French tradition, cabinetmakers do not buy a workbench, but instead build their own to the size and proportions they need.

Hammers

Striking, driving in, smashing, crushing: that is what hammers are used for. The shape and construction of the tool is so basic that even before picking it up, the neophyte can guess at its purpose. Grasped by the end of its handle, the tool inspires the gesture. A handle acting as a lever, a metal mass made of a projectile thrust forward, directed, and held back.

Imagine the tool's predecessors in the act of hammering or striking. A handheld stone that is too small and light would have no effect. Attaching it to a branch helps with length and the effects of leverage, but a branch is so thick that it is hard to handle. A large stone acts under its own weight, of course, and can be thrown at an object to crush or dent it, but it cannot be aimed precisely. And then you have to watch to see where it ends up after each throw and go pick it up to use again. Lightened, made more precise, more effective, and capable of repeating a motion, the hammer incarnates and implements the synthesis of these sometimes-contradictory discoveries and imperatives. The best possibilities from these variables were combined to create a certain freedom for the tool.

The idea of extending the tool with a branch was a good one, but a branch was too heavy to do the job well. It was later reduced in size to produce the right relationship between length, weight, and solidity. The heavy stone, with its imprecise impact and hard-to-control mass, was replaced by a much denser block of metal.

Up until relatively recently, the time it took a worker to complete a job was of virtually no importance in calculating its worth. Sharing the mentality of the time, neither the employer nor the laborer was interested in producing as much as possible in a given unit of time. Why then prefer twenty blows by a light, easy-to-handle tool to three by a heavy, exhausting-to-lift, hard-to-aim mass?

Within the huge family of tools, the hammer offers an excellent example of diversification. In fact, to perform the precise and repetitive operations required by any given profession, the artisan did not have the idea of just getting along, of being satisfied with one hammer for all tasks. The notion of one size fits all had no place in the hands of specialized workers. On the contrary, everyone adapted the hammer to his or her specific need. The search for efficiency, precision, and ease of handling brought about variations on the theme of form, weight, and size.

The T-shaped silhouette, however, was not abandoned. Specialized hammers all still retain that feature of the first prototype. They are all comprised of a metal head with a hole (or "eye") into which the top of the wooden handle is inserted. This joining of two materials is also one of the defining elements of the tool we call the hammer. Fitting one material into the heart of the other enables it to absorb the vibrations that add to the arm and shoulder fatigue of the person using it.

Before the discovery of metal, depending on need and what nature supplied, clever people attached a stone to a handle by tying two wooden shafts around it or by placing the stone at the end of a handle, forming a buffer. The head was attached by wicker weaving or by intertwining a length of cord, which may have been held in place by resin or gum.

The table, or the cheeks (the flat side of the head), is the broadest striking part, and the peen is the finest. A tiler's hammer handle is simply a grip, and the worker may use the force from the mass of the metal head to insert a tile by gently tapping it with the end of the handle. This way, the tool can add a third function to the specific uses of the table and the peen. The wood of the handle must be both strong and flexible. The woods currently used for handles are dogwood, hickory, and ash.

The multitude of hammers, as different as people.

Hammers are honored with flowers on their festival day in India.

The eye of the hammer has changed shape over the course of time. Originally round or oval, it became quadrilateral. It was found that this shape weakened the joining of metal and wood. So a hole with two parallel sides and a pair of semicircles was developed. As the cavity widens toward the top, a safety wedge can be driven into the end of the handle securing the wood to the metal, thus sparing the user the risk and annoyance of the head flying off.

For a long time, the head of the tool was made of steel-plated iron; only the two striking ends were made of steel and were welded to the iron body. Then there was a transition to hammers with all-steel heads. Special steels (carbon, boron) enable us to produce tools that medieval artisans would have considered works of magic. They would recognize their form and their weight, and understand their use, but they would be amazed and astonished that the tool needs no special care, and the table never needs to be recast. Metallurgy makes for deceptive

appearances. Today's hammer looks like a twin of the ancient tool, and there's no way of knowing without using it that it is stable and virtually indestructible.

The blacksmith, the locksmith, and the wrought-iron worker use various types of hammers. The largest, called the double-faced sledgehammer, can weigh between 6½ and 22 pounds; it is held in both hands. The head shape, a metal rectangle, is the simplest there is. Then there is the forge hammer, which can weigh as little as 1½ pounds. In order of decreasing weight, we also find the large bench hammer (about 1¼ pounds) and the riveting hammer, which can weigh only ¼ pound.

Artisans who work metal also use tools that look like hammers (socketed iron heads with a peen attached perpendicularly to handles), though they actually belong to a different family. The blacksmith holds the head to the red-hot metal and strikes it with a blacksmith's hammer. The top swage is used to shape the metal, and the symmetrical bottom swage makes the other half of the casting. Using the cutter, the worker splits metal, the punch pierces it, and the various different blacksmith's hammers (flatter trimming hammers) are finishing tools. These make it possible to produce flat surfaces.

The farrier keeps a hammer with an unusual shape—the farrier's hammer—within arm's reach. It is relatively light (under 6 pounds) because it has to be wielded by one hand, while the other obviously has to be free to hold the iron on the anvil. It seems to come from a world of curved geometry with no straight lines or right angles. Its back is round, its sides are flared, and its oval table is rounded. The handle itself describes a forward curve. Far from being symmetrical, with respect to the socket hole, the metal mass is shifted forward. Holding a farrier's hammer by the end of the handle is immensely illuminating: built around imbalance, the tool seems possessed by a force. It almost impels its holder to perform the gesture of striking.

The shoeing hammer is used to drive nails into the callus of a horse's hoof. It has a long, straight cylindrical handle, while the reduced metal part is suited to delicate, precise work. One type of shoeing hammer looks like a miniature sledgehammer. The poll of another is curved downward like the beak of a bird of prey; split in the middle, it is a claw used to pull poorly driven nails.

However, there are more ways of working metal than in red-hot bars. The coppersmith, tinsmith, and auto-body worker shape metal worked in sheets or plates. To do so, they use a large variety of hammers.

The smallest of these, the small bench hammer, has a short handle, a ball peen, and a square poll. It is used for precision work.

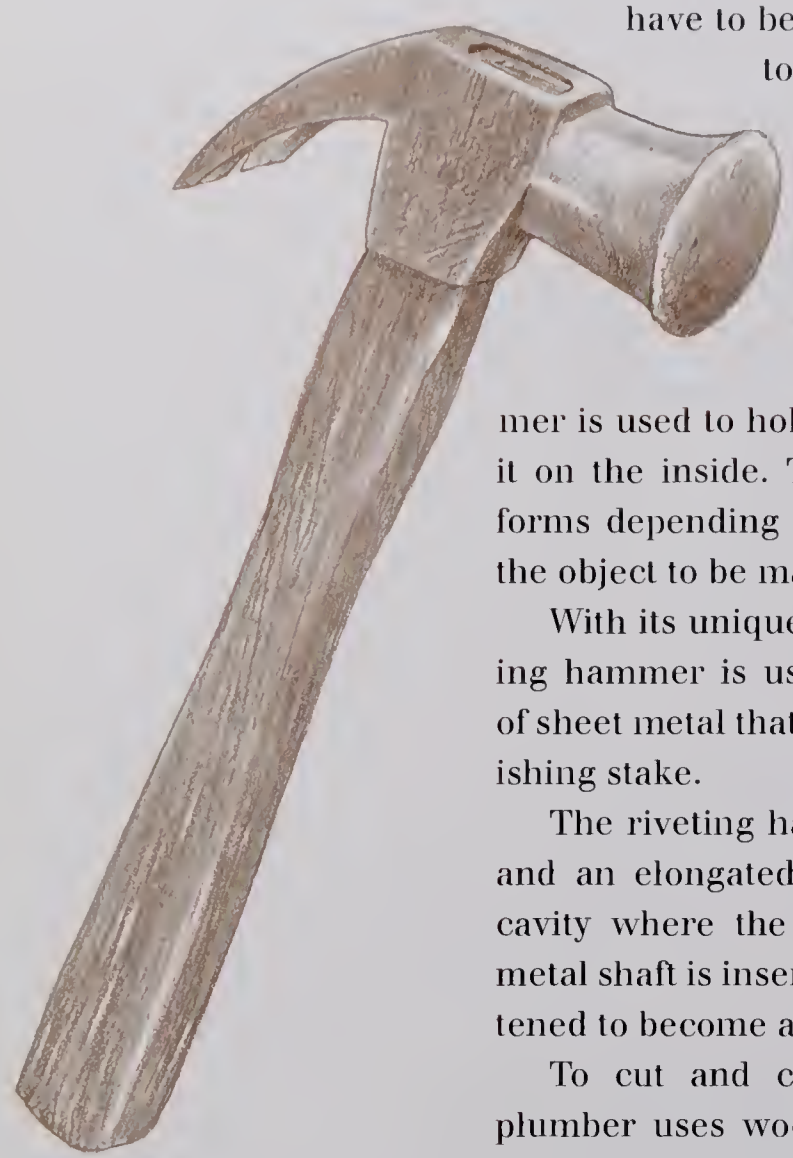
The heavy planishing hammers, more massive, have curved faces so they don't leave marks on metal, as an angular head might.

The planishing hammer completes the work begun by other tools. Its meticulously polished head permits it to remove any marks larger tools have left behind. Watching a coppersmith or tinsmith at work, you quickly realize that their profession involves more than shaping a metal plate by beating it on a simple metal support (stake) or in a solid or hollow "mold" to match the shape.

Part of an artisan's time is spent removing the increasingly smaller and closer edges left by the hammer blows; they look like meshwork facets and scales (and can

Two identical faces linked by a curve—elegance made hammer.

> The greatest moral victory that man has ever won is the workman's hammer. The workman's hammer turned destructive violence into creative force. From the club that kills to the sledgehammer that creates, there is a line from instinct to high morality.
>
> Gaston Bachelard,
> *La Terre et les rêveries de la volonté*
> (Land and Dreams of the Will)



Crowbar and hammer attached to the same handle.

still be seen on some saucepans). They have to be progressively eliminated to create a smooth surface. If you were to remove all the straight edges of a cube that is made of wood, you'd end up with a cylinder.

The planishing hammer is used to hollow out metal by striking it on the inside. This tool comes in many forms depending on the size and shape of the object to be made.

With its unique, rounded head, the raising hammer is used in striking the inside of sheet metal that has been set over a planishing stake.

The riveting hammer has a round head and an elongated peen with a cylindrical cavity where the upper, jutting part of a metal shaft is inserted. This part will be flattened to become a rivet head.

To cut and connect lead piping, the plumber uses wooden and rubber mallets so as not to harm the lead surface, as lead is as malleable a metal as there is. For jobs requiring force, the plumber wields a pigskin mallet.

When plumbers work on the street or in a building courtyard, they make sure to arrange their boxwood mallets on the surface of their workbench. There is a slight angle between the "beating" part of the tool and the struck object to leave room for the user's fingers.

A simple glance at this tool bridges great distances in space and surely also the centuries—isn't it the same shape as the tapa beetles from Oceania? Similar responses by human artisans to similar needs.

In addition to the classical hammer, the mechanic uses a riveting hammer with a peen that extends all the way to the handle. The auto-body worker may use a so-called fitter's hammer whose peen is in the shape of a semicircle. If, however, the task is to fit fragile motor parts, a lead-headed lump hammer is used. For obvious reasons, the unwritten law is that the material of the tool has to be tougher than that of the piece being struck; the artisan has to reshape the lead surface pitted by use.

The jeweler's and engraver's hammers (or chasing hammers) owe the shape of their end—a small flat metal disk—to the fact that they have to strike the punch directly, and they have to be used precisely. Their shape ensures the greatest possible precision.

Working stones follows an unyielding order. Just as a river doesn't flow toward its source, you can only go from large to small. Stone starts as huge blocks in the hands of quarrymen and is split off into smaller blocks using drills. The pavers reduce the stones and pebbles to gravel using a sledgehammer, which has a characteristic shape—a dense head and a long, flexible hazelwood handle. The famous painting by Courbet—which has yet to reappear—shows stonebreakers hard at work, protected from the hot summer sun only by flimsy cloth screens.

The hand hammer and the sledge are used to cut stone. The bush hammer, the crandall, and the patent hammer are used to true surfaces. For the final stages of stonework—the most delicate steps—the sculptor uses metal- and wooden-headed mallets to strike the tool (the wood is an excellent shock absorber).

For the variety of functions it performs (ripping nails, splitting, cutting, punching holes in slate, driving nails), the slater's hammer is a multipurpose tool dream come true in terms of its flexible and solid construction.

Tracing origins back further in the past, the mill pick, used to cut grooves into millstones, is a simple flat iron blade shaped like a pick roughly inserted into the rectangular hole of a strong handle. This joining system must have been invented not long after the discovery of metal. Though it is

The shape of the farrier's shoeing hammer speaks of refined work.

easy to make, it cannot withstand a series of violent blows.

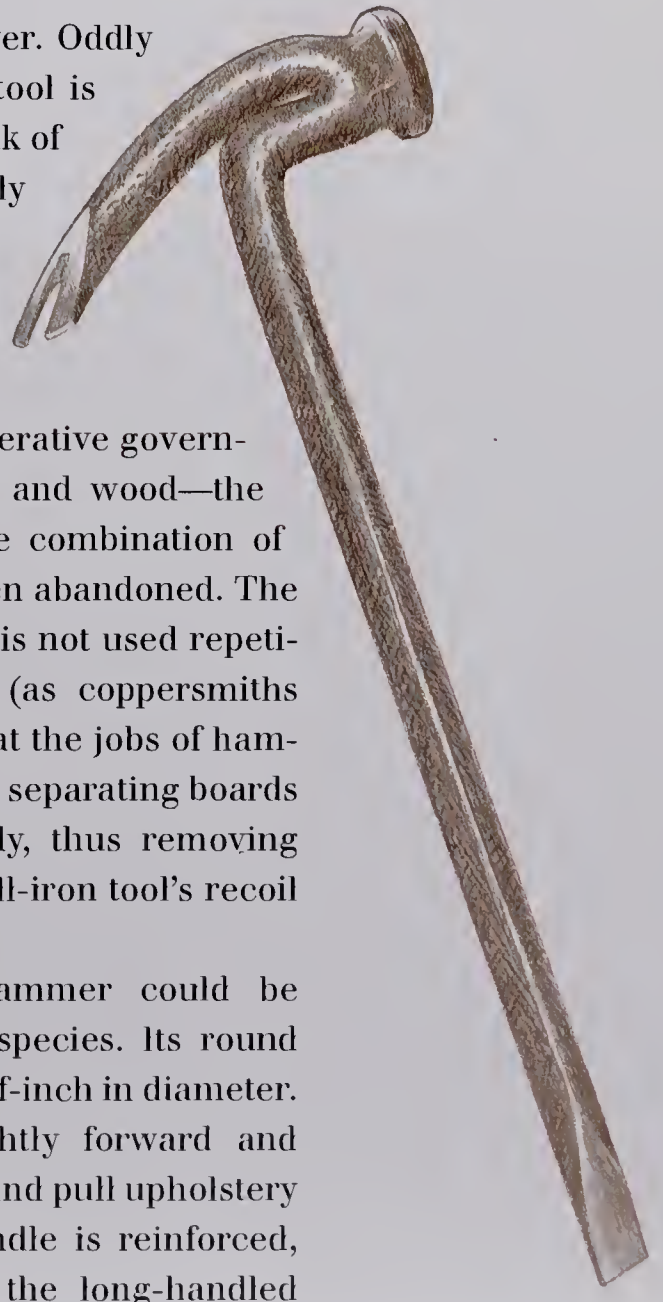
A number of different hammers are used in construction; some of them have one or two points (like the peen hammer, hand pick, or chipping pick), and others have one or two peens. The tiler's tools come from these tools, but are lighter, to correspond to the delicacy of the work. The fragility of the material requires it.

In days gone by, most houses were made of wood. As nails were not widespread, the main tool—whether it was employed by the carpenter or the cabinetmaker—was the mallet, which was used to drive dowels into the beams to hold together the wood frame. In fact, a chest or a cabinet was constructed using the same principles as those for building a house.

Of course, many of the hammers used by woodworkers have a curved and forked claw. In addition to that, each type of hammer has a shape adapted to a specific function. With its sharp peen, the box hammer can scrape bits of cement from boards that are going to be reused. The carpenter's nail-holding hammer (which is hung from a U-shaped hook on his belt) has an ingenious configuration: the side of the head has a nail-shaped gutter. With its help, the worker can start a nail in the right position with one hand before driving it with long blows. Carpenters also use axes and hatchets (with a notch cut in the flat part of the blade to pull nails and whose heel is used as a hammer). These multiple-purpose tools are valuable accessories, helping artisans avoid being overloaded. What's more, they can go from one task to the next using one hand, while the other holds the work.

There are other occupations ancillary to woodworking, such as making crates and pulling them apart to open them. The people who do this work have an all-steel tool that serves as hammer, claw, and flat chisel that is inserted between the boards and used as a lever. Oddly enough, the end of this tool is shaped like the steel shank of a hairpin (or a completely closed U); it is the hammerhead tapering down to the end of the handle as a curved forked claw. In this tool, the imperative governing the joining of metal and wood—the guarantee optimizing the combination of worker and tool—has been abandoned. The reason that this hammer is not used repetitively and continuously (as coppersmiths and goldbeaters do) is that the jobs of hammering, pulling nails, and separating boards are performed alternately, thus removing the shock effects of the all-iron tool's recoil from consideration.

The all-metal packer's hammer is used to pull nails and remove boards.



The upholsterer's hammer could be called the crane of the species. Its round face is no more than a half-inch in diameter. Its head is curved slightly forward and forked to be able to grab and pull upholstery tacks. The top of its handle is reinforced, which compensates for the long-handled

The chasing hammer is used in metalworking.

Below: **Struck by a hammer, a swage shapes soft iron.**

tool's fragility; this is a tool built for straight, clean blows. Its surfaces tell all, for their elegance announces a delicate and minute scope of activity. Its curves—the tool seems filled with a veritable horror of edges—ensure the artisan against scoring or scratching the wood of period furniture.

The picture framer's hammer, most often used on a horizontal surface, has a distinct head, which in cross-section looks like a trapezoid. Thus, when the hammer is slid along the flat surface, the handle is lifted, giving the user's hand complete freedom of movement.

The bungstart is a flat-headed cooper's mallet with a long, flexible handle used for a very specific purpose: to remove the stopper (bung) from a barrel by hitting the stave in which the opening was made.

The forester's marking hammer has two faces. On one end, there is a hatchet blade, which is used to remove a small amount of bark from a tree that has been selected to be felled; on the other, the back of the tool,

> The blacksmith begins his day's work with the arpeggios of his great force. The hammer dances and sings before it rises. After this clear sound a dull blow falls.
>
> **Gaston Bachelard, *La Terre et les rêveries de la volonté* (Land and Dreams of the Will)**

there is the owner's letter or symbol, which can be stamped into the lumber. It is the symbol of the owner's power (be it the State, the town, or a private individual), and, remarkably, at the same time it is a utilitarian object. In this respect, the hammer may be closer to the ancient sacrificial knife, perhaps the lictor's ax, than to what is depicted on coats of arms, fly whisks carried by African ambassadors, and the ceremonial New Guinean hatchet, which have become signs and scepters.

The shape of the hammer a farmer uses to beat a scythe blade—to straighten it before sharpening—is a matter of personal choice, habit, and local or regional tradition. As a rule, such hammers, which have very short handles, can have a face and one or two peens; their profile can be classical, with an imbalance in favor of one or the other work surface to use the effect of weight; or they can take the form of an arc of a circle over a square base.

Though it doesn't need to be ornate, the shoemaker's hammer is a tool with an elegance that attracts the eye and the hand and makes you want to hold it. (Who can tell if the vocations of artisans were even decided by the beauty—peaceful or threatening—of a tool? This would be quite apart from their being symbols of power, virility, victory over matter, and so on.) The handle of the shoemaker's hammer is relatively short, suited to close work. Agility here is more important than force; the head is extremely light, in the shape of an arch. One end has a round, slightly bulging face that is used to drive nails but also to strike the leather, to soften, spread, and smooth it. On the other

end, the peen widens and flattens—this piece allows the shoemaker to work on the inside of the shoe.

Tack hammers, also used by the shoemaker, have a compact head and two round faces containing grooves that slip over the tack.

While the coppersmith's planishing hammer is special, with its long head ending in a steel ball on only one side, the goldbeater's hammer resembles a metal sugarloaf with an attached handle. It has a flat, round face with turned-up edges. The steel does not directly touch the precious metal, which is held by two very smooth small hardwood boards or—alternatively—between two sheets of parchment. It is used to make gold leaf for picture framers, bookbinders, and architectural gilders; the gold may also be used on sculptures or statues. The gold leaves are so thin as to be translucent and so delicate that they are removed from the pages of the book where they are stored with an electrically charged brush. Hundreds of hammer blows were needed to produce each square leaf, a few square inches in size. At the end of the day, the artisan carefully picks up and saves the smallest pieces of the precious scraps.

Hammers are such a highly diversified species that you will never have occasion to use them all in one place. Admittedly, these tools are unequally represented in artisans' workshops. Certain professions use only a few hammers that are all quite similar and differ only in size. For the sake of convenience, artisans choose the type that corresponds to their field of activity. This results in shoemakers' hammers, cabinetmakers' hammers, and hammers for blacksmiths, farriers, and goldbeaters. On the other hand, coppersmiths and copper manufacturers use a huge range of hammers on their anvils. The reason for this profusion is simple: these hammers are not generic, but specialized. They are not used to force one piece into another, but rather to give, blow by blow, a desired shape to the metal. After using one, the artisan stops and takes up another. In the end, each tool plays a role in fashioning a metal container, going through the worker's hands like so many acts on a stage.

It is worth mentioning that when the artisans pick up a hammer, they automatically hit the workbench with its end to make sure that the head is seated properly in the wooden handle. The hammer does not always abide by the law of the strongest, the heaviest, the hardest. Some used for delicate work are soft-faced tools with hardened rubber or plastic heads, copper or lead-headed sledgehammers, and mallets with heads of horn or banded leather. Because the wooden mallet, prone to rapid wear and tear, has to maintain the balance of its two parts as long as possible, master builders of old recommended that sculptors turn the handle of the tool in their hand after each blow.

Above: **The dual-purpose shoemaker's hammer**

COATS OF ARMS BEARING TOOLS

Under the ancien régime in France, families or towns that did not have ancestral escutcheons with fleurs-de-lis or rampant lions met the need to create coats of arms by using plays on words. These "eloquent coats of arms" were by no means indications of inferiority. Their essential element was to present this sign of originality.

So it is that:
Three hammers for the town of Martel,
Three rakes for the folks in Rethel,
Three mallets for Mailly,
One saw for Siret,
One harrow for Hersart,
Three adzes for Renty,
And power for Hautefort.

The escutcheon of the town of Rethel contains three gold rakes.

Millwrights

Making a file, a tool made of tempered steel, seems an impossible undertaking. How can you cut into metal hard enough to work and remove iron?

A millwright, or tool- and diemaker, is an expert in these triumphant meetings between materials. There is no ideal material with which to make all desirable and possible tools. Form, weight, density, and texture must be combined to obtain maximum functional efficiency. Instinctively, humans avoid effort and risk. We don't pick up a sledgehammer to crack a nut. For a basketmaker, a tool made of boxwood that doesn't cut into the twig is preferable to a metal cutting blade. A cow bone flattened at the end is perfectly suited to lift the bark off an oak tree. Lumberjacks use and carefully store the hardwood wedges they make; they are less dangerous to handle than iron wedges. With patience and a steel blade pulled through sand, the monument maker cuts a block of granite. By themselves, a steel wheel and a diamond incise a smooth glass surface. A bronze-bladed hatchet can cut soft limestone.

People have other allies in this struggle against matter: chemical products (acids that attack leather), heat (which melts lead and softens iron), water (which flows over the skins at a tannery), cold (simply coming into contact with cold iron pincers neatly detaches the glass stem from the glassblower's blowing pipe).

Making files illustrates how this combat between metal and metal can be made easier by using the ingenious shortcut of taking the state of the material into account. It is only in the final phase that the file will be hardened. Once it has been tempered, it is impossible to cut the metal.

Miniature planishing hammer, a millwright's tool.

Millwright's chisels.

Before the millwright gets hold of it, the steel shank is forged so as to begin to assume the shape—round, triangular, or flat—and length of the desired tool. In particular, the tang—the part that will be inserted into the tool's handle—is hammered to be rectangular and tapered.

The millwright's patient work begins. If you count the fine grooves engraved on the file's two or three sides, it is easy to believe the professionals who speak of two thousand hammer blows required to make certain files.

The artisan has very few tools to work with. They include a block (a support), a special hammer, and a set of small file cutters.

The block (striking table) is a cylindrical wood base—which gives it height—supporting a metal rectangle—for stability. On top of this is a thick wooden board inlaid with a soft metal gutter into which the artisan places the file. The file is held in place by two leather straps (table dog) tightened over each end, with the weight of the worker's foot supported by a low buckle like a stirrup.

An odd hammer whose metal head looks more like a heavy ingot than a normal hammerhead is used for this kind of work. In accordance with its use, the handle is attached to the very thick square head at the back, not the front. The tool is remarkable in that the handle is behind the peen and the characteristic curve of the head is toward the piece being struck. The shape of this tool makes it a perfect example of one whose shape, imbalance, and dynamism immediately tell you what it does. Comparable to the farrier's hammer, though far more impressive, the millwright's hammer, which is held at the end of an extended arm, places so much tension—such a degree of imbalance—on the hand that anyone who holds it instinctively has to shift it toward the back. It is made to mark each groove at an angle—aggressively, as it were—by hitting toward oneself.

Given its weight and form, this hammer requires no grand gestures; it must not be used with too much force. Unlike a glassblower or carpenter, the millwright is content to work in a very small area, a cramped space.

The tool hit by the hammer is a burin, a small piece of tempered steel without a handle, which is used to cut fine isosceles-triangle–shaped grooves in the file, the edge representing the base. The other end is the chisel head, a thickening in the shape of a large nail. Burins vary according to the size and shape of the file being made.

The half-round file is flat on one side and convex on the other. As the name says, a square file is square. Finally, the rat's tail file is shaped like a cylinder with slightly tapered ends. Named for their shape, each type of file is subdivided into categories by the size of its teeth: coarse, bastard, second cut, smooth.

Files are used to plane a metal surface, to cut the material to allow fitting.

Even though rasps come from the same workshops, they certainly belong to another family. Instead of grooves, they have raised triangular teeth punched with a pointed tool called a file cutter, or burin. They are used to remove a layer of or round a piece of wood.

The file cut this way, the grooved rasp, was then heated until red-hot and plunged into water. Due to the high quality of the metal they were made of, they were often reused or used to make other tools.

Manual punching of files, a type of work requiring force, patience, and agility, has come to an end, at least in Europe. Nowadays, a huge machine is used to cut all the grooves on both sides in an instant, at the press of a button.

The image of that which is, essentially, impossible to cut—something that can eat into metal—the storyteller's file, is attacked at a clockmaker's by a hungry serpent and teaches the reptile a lesson because it has nothing to fear but the ravages of time.

The burin cuts grooves into a file, which is used to remove metal.

A slender tool for a delicate job.

Clockmaker's Hammer

A picture of this tool that does not give the scale conveys an entirely wrong impression. It looks like one side of the head at the end of a very long handle is an ax and the other a cross-peen hammer. It's nothing of the kind. This clockmaker's tool, which is ultralight and only inches long, is used to strike lightly—you could even say caress—a piece of clockwork to put it in place. The operation is delicate, for the escape wheel or the drive mechanism has to fall into place on an axis which, due to the complexity of the mechanism and intricacy of its pieces, can't be easily reached. That's when the little hammer, which could also be called a vibrating hammer, comes on the scene. Actually, the clockmaker's hammer's tapered handle is a piece of whalebone, and the slightest movement starts it vibrating. The gentlest force applied to this most delicate of delicate tools is transmitted as a series of incredibly light blows.

Blacksmith's Tongs

RAJASTHAN

A hand reduced to its essentials: a thumb and an index finger. The joints are replaced by a solid flat rivet. But the comparison stops here. These two iron fingers can be placed in a fire, and they can hold a piece of glowing metal on the anvil under the blacksmith's hammer. To keep the worker away from the heat of the forge, the two handles of the tongs are made as long as possible. Finally, the semicircular grips are two tools in one. They supply maximum pressure on the lever arm, which is very long in relation to the pincer's jaws; in addition, their extreme length ensures optimum cooling.

The blacksmith's tongs are identified by their long handles.

Tinsmith's Tools

This Saint Andrew's cross configuration (X), which articulates where the two halves join, is the basic pattern of all tools used to hold, grab, or grip. The surgeon's hemostat is the youngest member of a family whose members comprise those used in fitting, the garage, and the forge; huge wooden cabbage tongs; and the even heavier ones used by dyers who work outdoors in modern Moroccan towns.

Covered by a fine layer of tin, an iron sheet will not rust. In addition, tin is strong for its weight. Easy to make, tin objects were inexpensive. Of course, they ruled the kitchen (the ladle, skimmer, funnel, sieve, rice bowl, various vegetable graters) and the dining room (the pitcher, coffeepot, oil lamp, cruets), and were used for transporting and various jobs (the milk can and the oil can used by truckers, auto mechanics, and train engineers) or for storage (cookie tins or spice jars). The flower preserver's box and the watercolor artist's water container are also produced by the tinsmith.

The tinsmith gets by with few tools. First there are free or mounted snips and chisels (the same used by other metalworkers) that cut sheet tin using stencils and templates.

Then there is an anvil, without horns, like the farrier's but rectangular so the worker can make a cylinder by turning the piece of metal. There are also other, more complex anvils on which you can shape two half tubes to be soldered together.

Of course, the tools that miraculously transform flat sheet metal into the curved space of a container are hammers, broad or round, narrow or flat. Just as a tailor uses a needle, the soldering iron seals the surface seams. The most rudimentary is a simple hammer with a pointed copper head, a long iron shaft, and a wooden handle. It is constantly taken from the fire to be cleaned, pressed against the tin solder, and quickly run over the area where the two pieces are supposed to be joined.

The tinsmith's and plumber's servant: the soldering iron.

A tinsmith's workshop evokes painter Fernand Léger's studio: gleaming metal cubes, curves, and cylinders, now and forever.

Coppersmith

It takes a vivid imagination to see a sheet of copper in the shape of a pot. The coppersmith is not one of those workers who removes material (like the lumberjack), who cuts it (like a stonecutter) to find the cube inside the block, or who puts it together (like the ropemaker). The coppersmith's work makes you think instead of the potter, who shapes a formless mass to create the spaces in containers and other utensils. The difference is that the potter's clay comes in a single mass, while the copper sheet, laminated or hammered, is worked material.

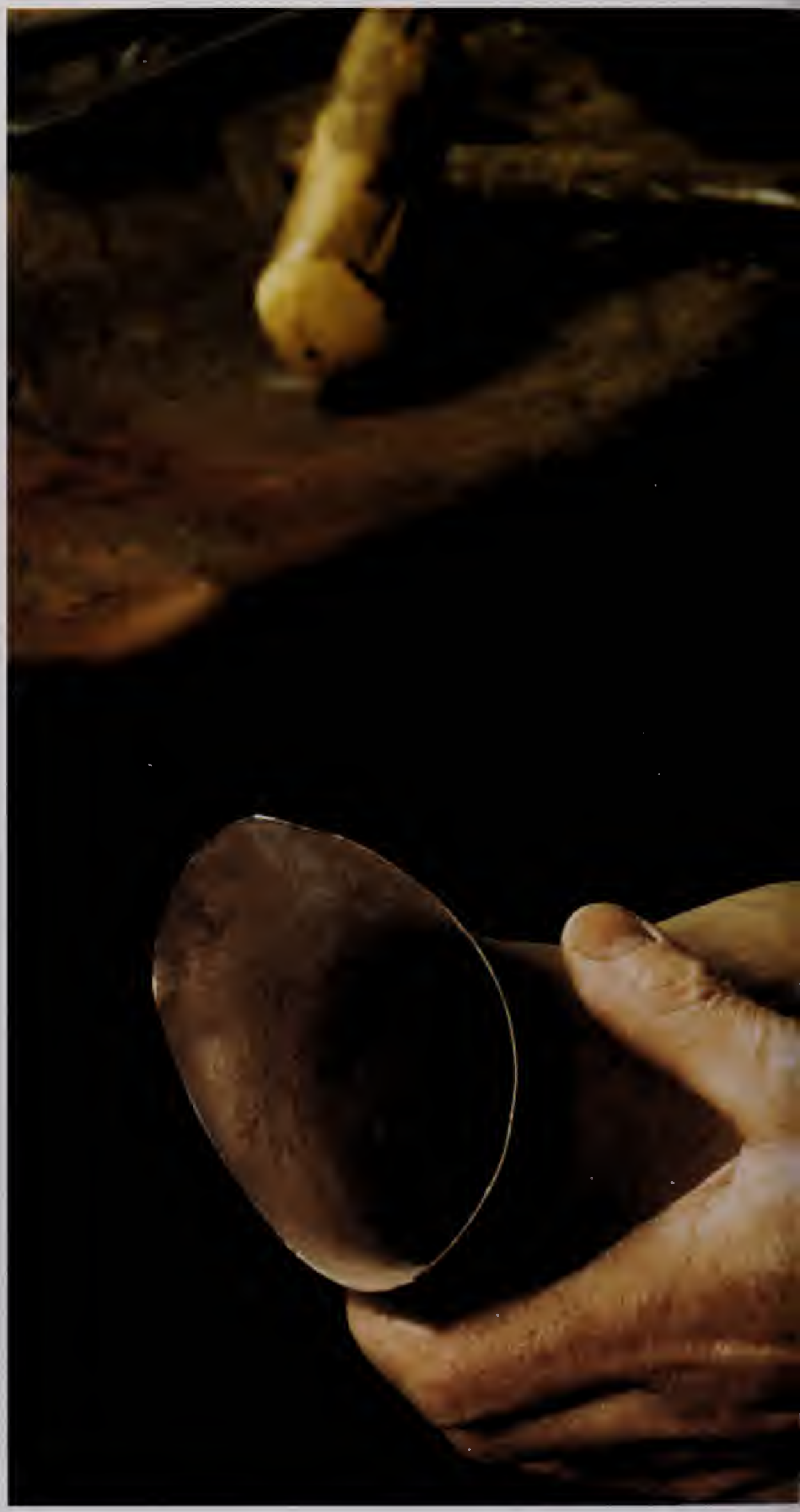
The coppersmith's work starts the same way as that of many, though by no means all, other artisans—by defining, measuring, drawing.

Armed with snips—heavy and implacable pruning shears—the coppersmith cuts a sheet into a surface matching a template. He keeps a collection of templates just as a fashion designer maintains her patterns.

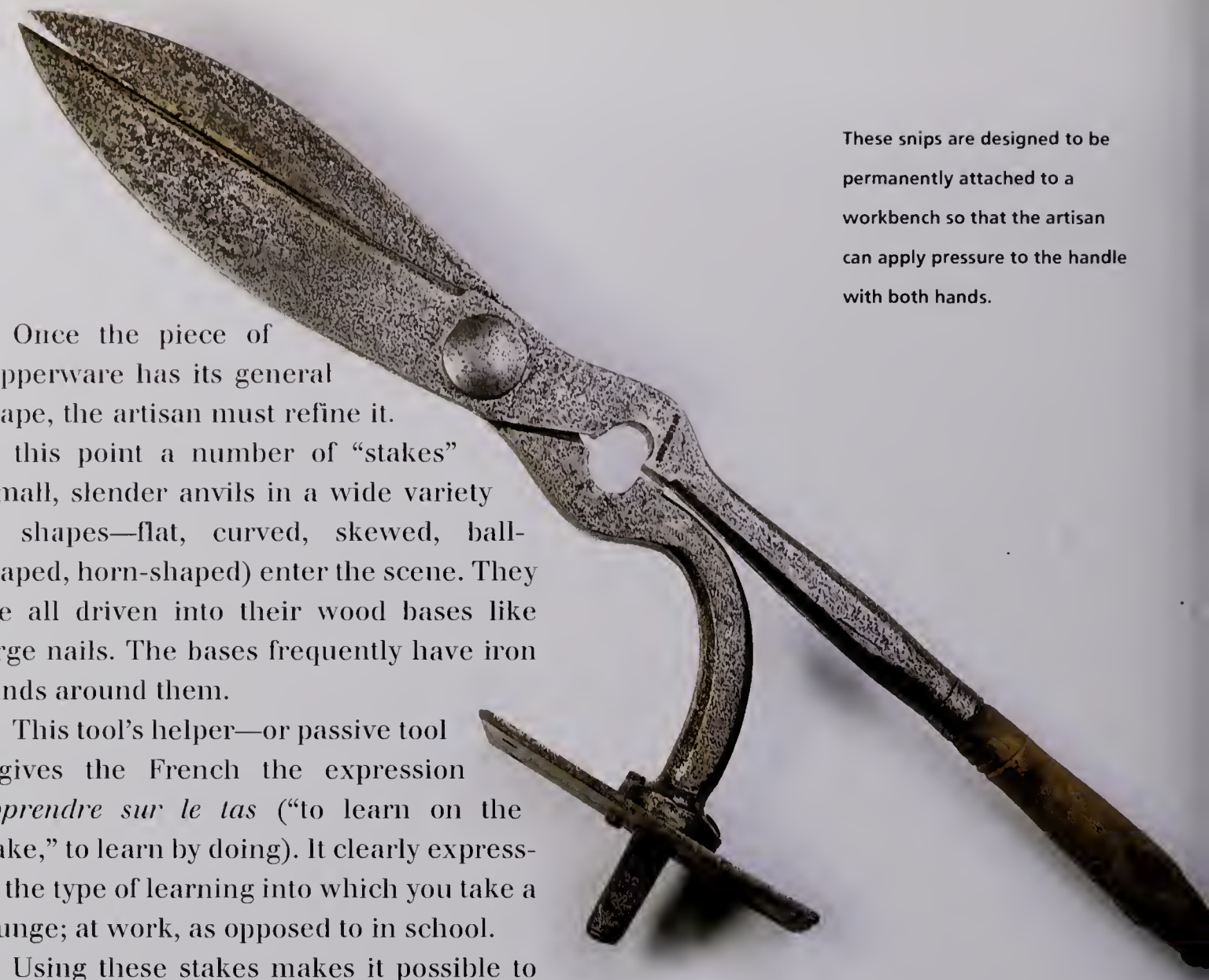
Then, controlled by eye and ear, and relying on professional training, skillfully modulated, he repeats the same gesture he has made ten thousand times before. He hammers, again and again.

He doesn't hammer in the air. To produce a shape, the artisan requires a point of support, just as an echo needs a wall.

When beating copper, the best support can be a wood block cut in the desired shape that is wrapped in leather held in place by copper bands. This way the blows are softened and the artisan who gradually beats the metal thinner and thinner avoids the risk of breaking it with too powerful a stroke.



Little by little, a metal pitcher takes shape.



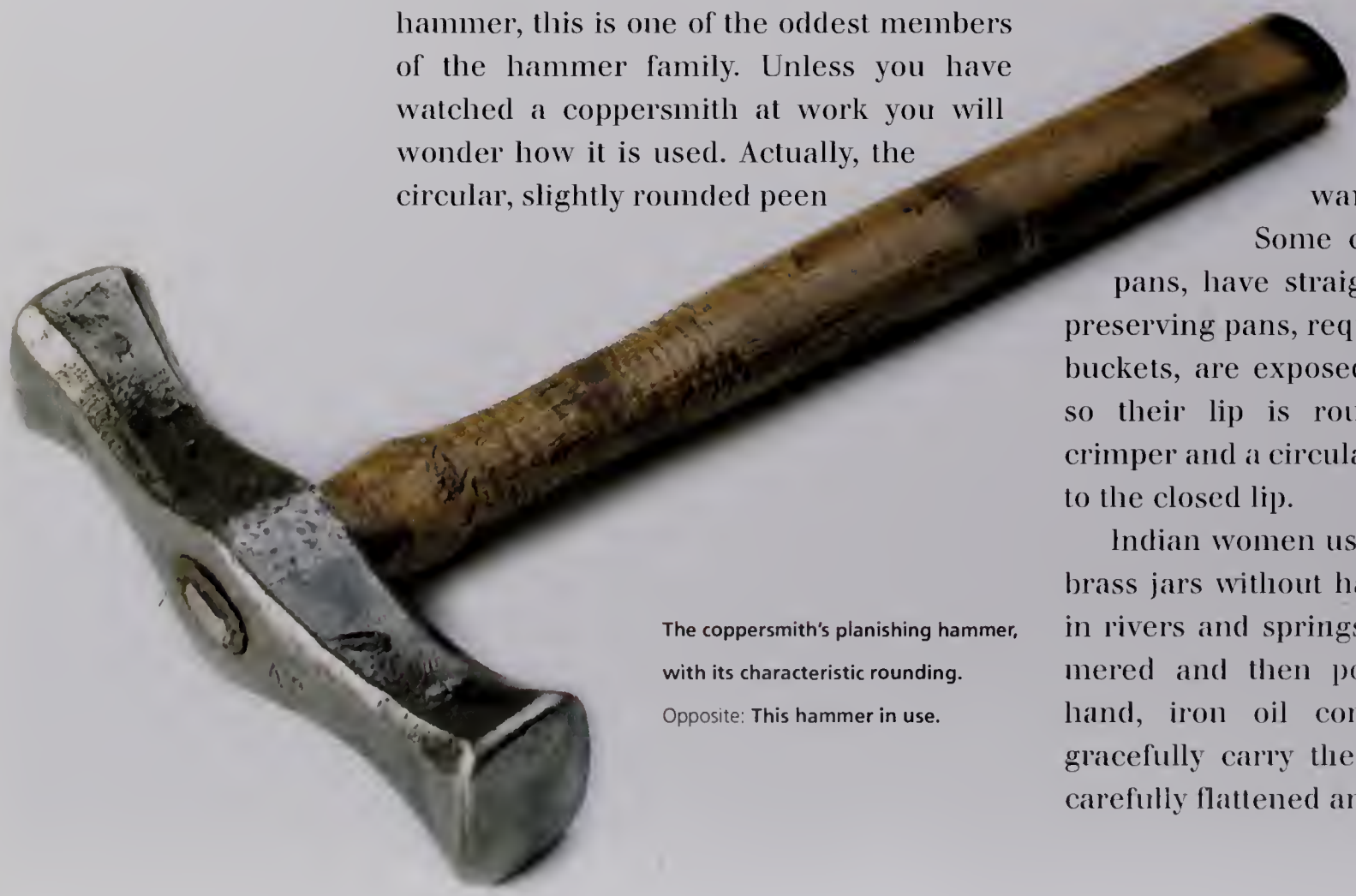
These snips are designed to be permanently attached to a workbench so that the artisan can apply pressure to the handle with both hands.

Once the piece of copperware has its general shape, the artisan must refine it. At this point a number of "stakes" (small, slender anvils in a wide variety of shapes—flat, curved, skewed, ball-shaped, horn-shaped) enter the scene. They are all driven into their wood bases like large nails. The bases frequently have iron bands around them.

This tool's helper—or passive tool—gives the French the expression *apprendre sur le tas* ("to learn on the stake," to learn by doing). It clearly expresses the type of learning into which you take a plunge; at work, as opposed to in school.

Using these stakes makes it possible to work the surface of the container being produced. But the coppersmith can also wish to work the inside. For this a planishing hammer is used.

Along with the millwright's striking hammer, this is one of the oddest members of the hammer family. Unless you have watched a coppersmith at work you will wonder how it is used. Actually, the circular, slightly rounded peen (the striking part) is not near the socket eye and placed perpendicularly to the axis of the handle. Rather, it is located at the end of a long iron bar at a 45-degree angle to the handle. The artisan sits and uses small blows on the copperware, and turns it slowly.



The coppersmith's planishing hammer, with its characteristic rounding.

Opposite: This hammer in use.

Some containers, like saucepans, have straight edges. Others, like preserving pans, require more work or, like buckets, are exposed to rougher handling, so their lip is rounded using an edge crimper and a circular metal rod is attached to the closed lip.

Indian women use very attractive round brass jars without handles to collect water in rivers and springs. These jars are hammered and then polished. On the other hand, iron oil containers in Rajasthan gracefully carry the traces of large rivets carefully flattened and smoothed.

The Noise of Tools

Henri Bergson once said, wittily, "All progress is translated into a new noise," referring to the piercing or fierce cries of the mechanized tools used in the city and the country. The jackhammer, the electric drill, the pick hammer, the chain saw. In the far-distant past, we can imagine the astonishment of a group of prehistoric hunters when they heard a flintcutter at work in the distance—the sharp blows of the wood or antler hammer on the flint interspersed with the crystal-clear noise of the piece breaking or being thrown on the pile.

Except for the occasional sound of hand shears being placed on a wooden table, a fashion designer's studio is quiet. The blows of a felling ax shake the entire length of a tree trunk, so much so that you think you can hear the branches and leaves shake. The log saw, used by two workers, puffs away regularly without ever getting stuck. We know that it will never let go, that it is patient and unrelenting, that it will triumph. Metal against metal, the sledgehammer strikes a wedge. Surrounded by the wood, it answers with a dull cry.

A locksmith's hand drill barely creaks because, if properly handled, the file gives off only a kind of cooing broken by silence that seems like breaths. A bronze worker from Nogent (France) says that he could tell if an apprentice had botched a job by the sound it made.

Background: The score of Richard Wagner's *Siegfried.*

He forced the file to go back and forth, making a certain sound. When, however, he—the bronze worker—filed a piece (he combined gesture and words), it sounded like *hoo . . . hoo . . . hoo.* Metal against metal, resonant and sonorous, like a gong or a bell, that's the irresistible appeal for schoolboys of a group of men who quickly set up a circus tent, as it is so wonderfully narrated by William Saroyan.

The anvil is a real bell, which the blacksmith and his apprentice bring to sonic life with full force and also with small blows that seem as if they were meant to quiet the amount of vibration. The blows are delivered in rapid succession, the bursts come at the same intervals, as if a famous pianist were to place her instrument near a forge whose music she accompanied by very precisely filling the pauses between the blows. Wagner vigorously and strikingly set to music the song of the forge in *The Ring of the Nibelungen.*

For some tools the noise has to be added. When the farmers in an African village work together in the fields, fifteen or twenty across, they use hoes that each have an iron ring around the socket. At each blow these circles clang, helping to drive the workers on. This is not the discipline of a coxswain over rowers, but a type of encouragement, lending additional energy to the weaker ones who might otherwise fall behind.

> We heard the sound of the white soldier's ax at Little Piney. Its presence here is an insult and a threat. It is an insult to the spirits of our ancestors. Are we going to let them grow corn on their sacred tombs? Dakotas, I am for war!
>
> Red Cloud,
> Oglala Sioux chief

Hoho! Ha hei! Hoho! Ha hei!

Screwdriver

Compared to a hammer, which possesses a certain versatility, the screwdriver is part of a pair. Each one is used to drive the head of a certain-size screw, and not another. Likewise, since screws are also made to be unscrewed, the head groove awaits its corresponding screwdriver. If it's too small it will be unable to turn properly, and if it is too large it won't fit in the slot.

It seems that in this case a boundary has been drawn in the world of tools. And it is true. The use of a screw announces the entry into the world in which there is no more approximation, no more "settling." The precision of the screw's position corresponds to the adaptation of the tool that works it. To be sure, there is a degree of toleration for a screwdriver that is one or two sizes too small, but no more than that. On the other hand, to reverse matters, the meeting of the large screwdriver and the small screw gets nowhere. This is why a mechanic always has on hand whole sets of wrenches and screwdrivers. We are far from the woodcutter's world in which only a few tools are needed to cut down a large tree, no matter how different the tools. Each screwdriver seems to be filled with good intentions: it carries out to its absolute limit the operation for which it was designed and made, and then it gives way to the next.

A human invention, the screw is at the beginning of a truly new path in the development of technology.

The family of screwdrivers in a rack.

Hook

There is an intermediary between the immense contents of the belly of a cargo ship and the grabbing and lifting machines that unload them: the longshoreman armed with a hook.

This tool makes workers into one-clawed beings. It allows them to grab, to pull, to handle, for example, bales and bundles of wool or cotton which, though they are not all that heavy, are still difficult to handle because they are cumbersome and hard to grasp.

Depending on their work habits, longshoremen will choose a hook with a transverse grip (the base of the iron shaft will be held between their middle and index fingers, and the four fingers and thumb wrap around the wooden peg to insure maximum traction) or a handle along the extension of the hook's base.

Since hooks with extremely sharp tips can be dangerous for the workers or those around them and can also dig too deeply into the material being grasped, there is a safer design—the two-tipped hook at the end of a bent shaft. This type of small hook cannot dig more than an inch or so into a bale.

Finally, the ultimate refinement: the type of handle. Some hooks have a longitudinal grip made not of a single piece of wood but of a series of small wooden rings strung on the tang, or "root" of the tool. The same system, with leather rings, was used for knife and billhook handles. This guarantees a better grip, mostly by absorbing sweat so the worker's hand doesn't slip off the handle.

(It goes without saying that as a weapon, the longshoreman's hook is as formidable as the dreaded adze sometimes wielded in anger by quarrelsome coopers' apprentices.)

Observed by humans: the bird of prey's talon, the feline's claw.

LEATHER

The Tanner and the Tannery

The circumference of the tanner's lunette is a cutting edge.

Who can really say where leather comes from? Who wouldn't be fascinated to learn about its source? Who would dare claim to have invented it?

Photography and wireless telegraphy were invented by well-known individuals at very precise times and places—but leather is anonymous. For as long as it has been in existence, leather has been found around the world. It is used to make a wide range of items by an enormous number of peoples. There is the leather used to make Eskimos' boats and clothing; Native Americans' tepees; capes worn by Indians from Chile's southern tip; sandals worn on Tuareg caravans in the Sahara Desert; magic scrolls of Ethiopian peasants; crops used on Bactrian camels in the Gobi Desert; Egyptian goatskin *norias* (buckets); the shoes and belts of millions of people; and many other objects for utility and clothing.

Bone needles found in numerous prehistoric sites attest to the presence of artisans from the most faraway times; they prepared skins and used the needles to sew them. Sandals and ties made of leather straps have been found in ancient Egyptian tombs. When Odysseus set off on his ship for a leg of his long journey, Homer mentioned the provisions that were stored down in the hold and in leather bags. (It was as if he intended to teach a young navigator.) These are the very objects that have come down to us, including shoes, gloves, harnesses, bags, trunks, cases, wall and seat coverings, and so on.

The list of animals whose hides we use is amazingly diverse, including cow, sheep, goat, pig, and also seal, shark, ostrich, crocodile, snake, lizard, and many more.

Naturally, because tanning is both a mechanical (scraping, pressing) and a chemical process (using the astringent effect of tannin on skin), the ingredients used in the last step of soaking a hide will vary depending on what is available in each area. The most common is the tanbark from holm oak.

As a result of this soaking, the skin, which would otherwise degrade quickly, will become rot-proof. Furthermore, if it were left out in the air untreated, it would become dry and brittle; but, once it is tanned, it is soft and strong. And after being oiled, the leather becomes waterproof.

Traditionally, tanneries were distinguished by their need for constant running water; it was necessary to rinse large quantities of hides in flowing water. To this day, streets that run along a city's canal are often named Tanner's Street or Tannery Street. The workplaces were typically topped by a latticework structure that would allow the passage of fresh air for drying the skins. Finally, it must be said, tanneries made their presence known from afar because of the unpleasant odors that were emitted from the work areas.

The first thing one notices upon entering a tannery are the "river trestles," or tanner's beams. Workers lean their stomachs into one end of this half-cylindrical wooden form, while its other end rests on the ground. The hide, drenched in water, lies on top of the beam. The beams get their French name from the fact that leather workers would set them up along river banks to have easy access to an abundance of water.

Opposite. A view of the tanning district. Fez, Morocco.

After one washing and before another, the leathermaker scrapes the hide to remove any flesh, blood, and fat that might still cling to it. The worker uses several kinds of double-bladed fleshing and unhairing knives, both straight and curved. There is also that uniquely designed tool called the currier's knife, some examples of which have handles that are extensions of the blade, while others are equipped with two handles that are perpendicular to the metal, which is beveled in opposite directions. With the currier's knife, laborers can work the hide, moving up and down the length of the trestle and flipping the tool over in their hand.

The skin is left to steep for just the amount of time necessary to remove the hair. The skins aren't shaved, as one might think, but scraped off with a rounded or blunt knife. The rounded blade can be worked by the two handles that are extensions of the blade, and the hair should come off through simple grating. For finer work, artisans will use the depilatory blade. At first glance, one would think this tool came from a faraway time, centuries ago. It has a stone blade that fits on top of a wooden rod and forms two handles. The stone blade—fastened in its groove by two metal rivets—curves inward, marrying the convex form of the trestle.

Now the actual tanning and chemical process can begin. For several weeks, the skins are left in pits filled with water and the proper amount of tannin. The skins will periodically be stirred with various long-handled stirring tools: a type of bat with a leather sack tied with string to one end, a shovel, a thick block of wood with a perpendicular handle, and a bouloir.

After the tanned leather has been set out to dry, it must still undergo other steps before it can be sent to an artisan to be worked. First, it is softened with a small, double-handled

Preparing leather. Venice, sixteenth century.

After centuries, the same stances and gestures. Tannery of La Brède, Gironde, France.

wooden roller. Then it is stretched over a flat surface and flattened with a mallet. The outside of the skin—the side that once had hair (the grain layer)—is smoothed out with a tanner's knife that has two short handles and a glass blade. A similarly shaped tool with a stone or metal blade might be used as well.

Because there are hundreds of kinds of leathers and skins used for the most diverse of purposes—from the thick, rigid leather of sewer boots to the extra thin, close-fitting leather of women's gloves—other tools will be needed to give the malleable material the desired quality.

There is the lunette, a unique member of the tool population, with a steel disk, the entire circumference of which is a cutting edge. Its center is cut out and lined with leather so that the worker can hold and use it. As is often the case when an effective object is removed from its context, isolated from the gesture and stance of the worker, it becomes a kind of meteorite from an unknown place, lending itself to sundry suppositions. Therefore, one must picture the hide suspended from a bar at the level of the worker's head and hanging down to where it is held by tongs. The pincers are held close by a ring through which a leather strap can pass and loop around the worker's thighs. Standing up, the worker can adjust the tautness of the skin by simply leaning as he carefully thins its

flesh side. The tool is inherently dangerous, which is why in old etchings, like those illustrating the eighteenth-century French *Encyclopedia*, they are hung on a wall when not in use, high up and well out of reach of passers-by and people visiting the workshop. Using the lunette requires dexterity, sensibility, a light hand, and strict adherence to the rules. The leather must be supple where the tool meets the blade; it won't work on a hard surface. If one doesn't know one's tool and forces it, the damage will be tremendous.

Finally, there is the pommel. It is made of a rectangular piece of thick wood and a wide leather strap through which one's hand and forearm can pass. It has a curved sole, beneath which are different kinds of grooves and either thick or thin teeth depending on the type of leather to be worked and the effect desired (softening, smoothing); the cork pommel will have a gentle effect.

One version called the marguerite or demoiselle has a rounded, toothed sole made of wood from the service tree. As is suggested by their shape, pommels are worked in a rocking motion. Obviously, once the leather has undergone this vigorous massage it will retain its suppleness.

The largest hides at the leather studio, from bovines, are suspended from sticks acting as rudimentary hangers. The skins rest on a horse formed by a horizontal beam and four slanting legs, and are cut in two with a trimming knife.

Some animal skins will erase charcoal, as does a chamois; sharkskin can serve as a rasp; donkey hide can withstand drumming; goatskin can hold the air for bagpipes. Some hides, like Cape Town goatskin, will outlive their users. Skins can be transformed into a document case or can; furnish African warriors with impenetrable shields, as does rhinoceros hide; and connect the handle to the beating part of a peasant's flail, as they were in the past. The tremendously tough skin of the tireless eel that migrates from the Sargasso Sea were also used.

Awl

An awl is a bodkin used to pierce leather in preparation for the passage of coated sewing thread. The simplest of awls are comprised of a pointed piece and a small wooden handle. Some might also be slightly curved, which makes them easier to use. Some are triangular in cross section, flat underneath with a rib on the other side for reinforcement. The side-by-side cutting edges lend it a lancelike silhouette.

The artisan will of course sharpen the awl's tip on a stone periodically so that it remains useful. But one can never be too careful; a fall to the floor is always possible and therefore artisans keep their awls in a small turned-wood sheathe.

Not all saddlemakers in this world are professional and well established. There are also those who work on saddles only occasionally or when necessary. A central Asian or Mauritanian caravan may need to quickly repair a worn-out rein or thinned belt strap. The awl is preeious and indispensable and therefore does not leave the animal herder's belt.

A herder in north Afghanistan once showed me his awl and indieated that it was made not of two parts, but three, an astounding precautionary feature. There was the point and handle, of course; and between the two he pointed out a metal piece acting as a reserve of metal. If the tool were to wear down, one could simply heat the metal, hammer it to lengthen it, and form a new point to replace the blunt or broken one.

Artisans push the awl with a palm, which explains the shape of the tool's handle.

Parchment Knife

This Ethiopian knife is used in particular to prepare the parchment for prayer books.

Ethiopia, the country of the legendary Queen of Sheba, is a land of Christian faith where scribes abound. They are known as *debteras* and are highly respected. Their functions are many. They act as deacons officiating in religious ceremonies and also as transcribers of holy texts, scribes of magic formulas, nurses, magicians, dream interpreters, and more.

They also copy or write prayer books on parchment; these pages are bound between two pieces of wood and are sometimes illuminated. Many Ethiopians carry them in small leather cases that they hang from their shoulder. The *debteras* also organize, illustrate, and print the calligraphy for the famous "magic scrolls," goatskin bands that fit around the carrier's waist and are approximately four or five inches in width. The scrolls are often decorated (with geometric motifs, eyes, an effigy of Saint Michael) and covered with inscriptions that ask alternately for protection from enemies and for their misfortune.

With time, the talisman might lose its power, or the target of the curse might change. It would therefore be necessary to make a new scroll. Once the goatskin's hair and flesh had been removed and the skin was pressed, it would undergo chemical treatment (a soaking in a boiling mixture of plants or bark). It would then be thinned with this curved knife until it was translucent. With its special shape, the knife can be used in two ways: the straight edge is used to thin the skin, the crook to cut the strip.

As rustic as it is, this simple, coiled knife inspires long and respectful consideration. Is it not, like all those who have used it since the invention of parchment, the servant of writing, the vessel of human memory?

The case at the base of the marking wheel handle holds different kinds of wheels.

Cobbler's and Saddlemaker's Marking Wheel

One who sews for the first time is sure to find the job simple. It's plain logic to tie a knot at one end of a thread strung through a needle, for the thread must be stopped once the needle has passed through. Threading the needle requires a bit of patience, but, in the end, one succeeds, and will soon even be able to do it quickly. However, the succession of dots aligned on the fabric is most daunting. Double fault: not only do the markings extend to the left and right, in the most unsightly manner, but they are identical. The apprentice dreams of creating perfect stitching and sees that it is not easy. As is often the case—like the old cooks who, they say, wouldn't reveal all the secrets of their recipes—a detail—an aid, a guide, a kind of surveyor or pocket measure—is missing. It is the marking wheel, that wheel with piercing spikes attached to the end of a handle. In moving it along the surface of the leather, all you need to do is push it down firmly. A row of evenly spaced, aligned marks emerges, through which one will pass the awl to make the first hole.

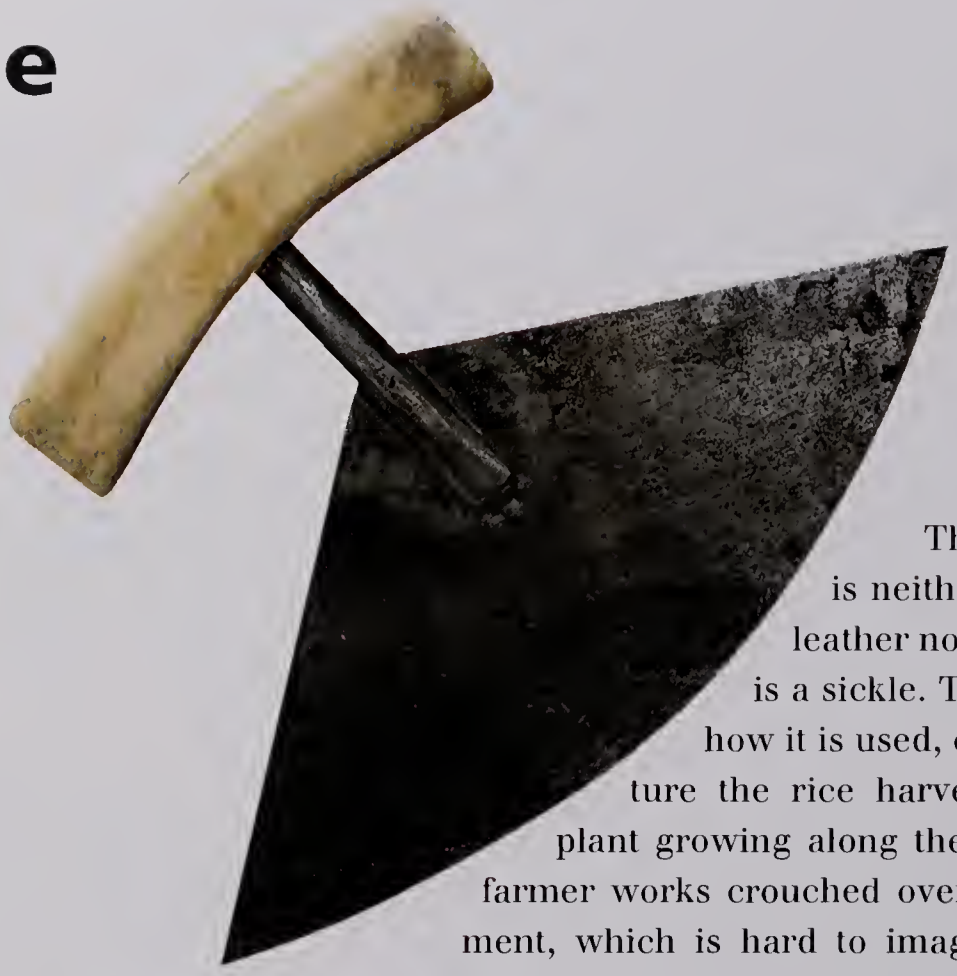
Opposite: **The saddlemaker and his panoply of tools.**

The cobbler makes shoes that last. Saint-Louis, Senegal.

Shape and Usage

The shapes of simple tools are indeed most revealing, indicating how it is that they are used. However, no tool is all alone; none came into existence through some miracle. Every example of every kind of tool belongs to a certain population and region and can be used to carry out a very specific task.

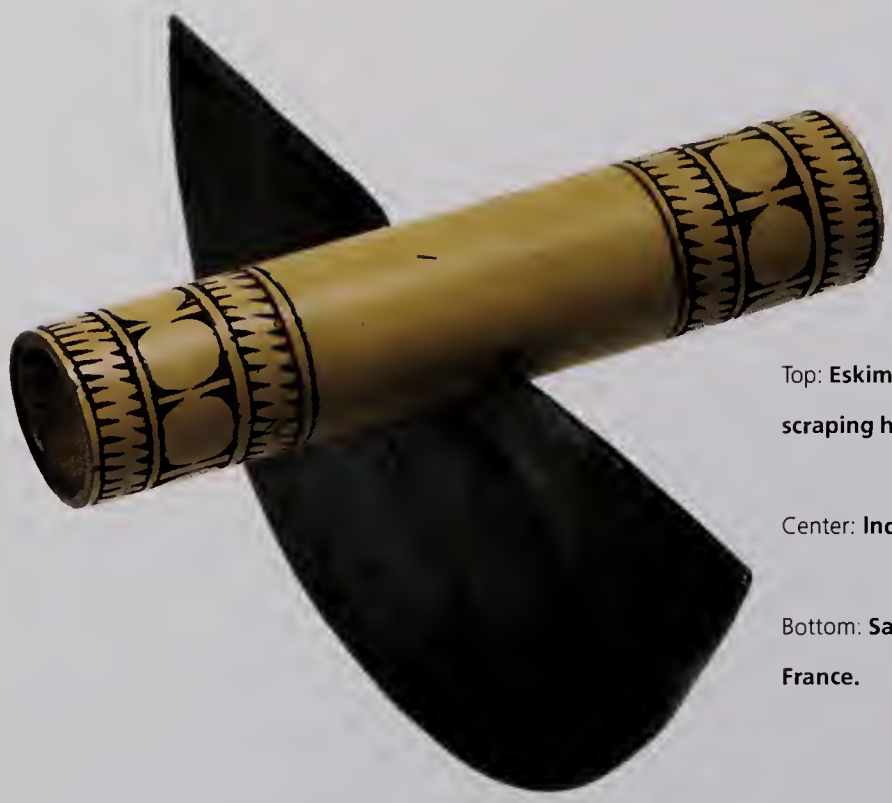
Some tools bear a misleading resemblance to another. For example, there are three tools that each have a half-moon metal blade. Despite their similar shape, they are not interchangeable; they come from remote worlds and the tasks they accomplish are different and quite specific.



The third tool is neither a knife for leather nor a scraper. It is a sickle. To understand how it is used, one must picture the rice harvest. With the plant growing along the ground, the farmer works crouched over. The movement, which is hard to imagine if it has not been observed, consists of holding the cylindrical axis in the palm, with the thumb wrapping around it, while the index and middle finger, on each side of a tin-can top (reused ingeniously) press the stalks of rice against the blade to cut them.

The blacksmith's hammer and the swage also have the same shape—a mass of metal at one end of a long handle. The two tools, far from having the same function, complement each other in their use. The swage has a long handle and can therefore be held over a hot iron. The hammer strikes it in order to imprint the swage's mark on the metal, for example.

The list goes on and on. Quite legitimately, artisans get ideas for their own profession from the shapes of tools of another. I once observed a betel vendor from the soûth of India cutting his nuts with an old candle snuffer from England.



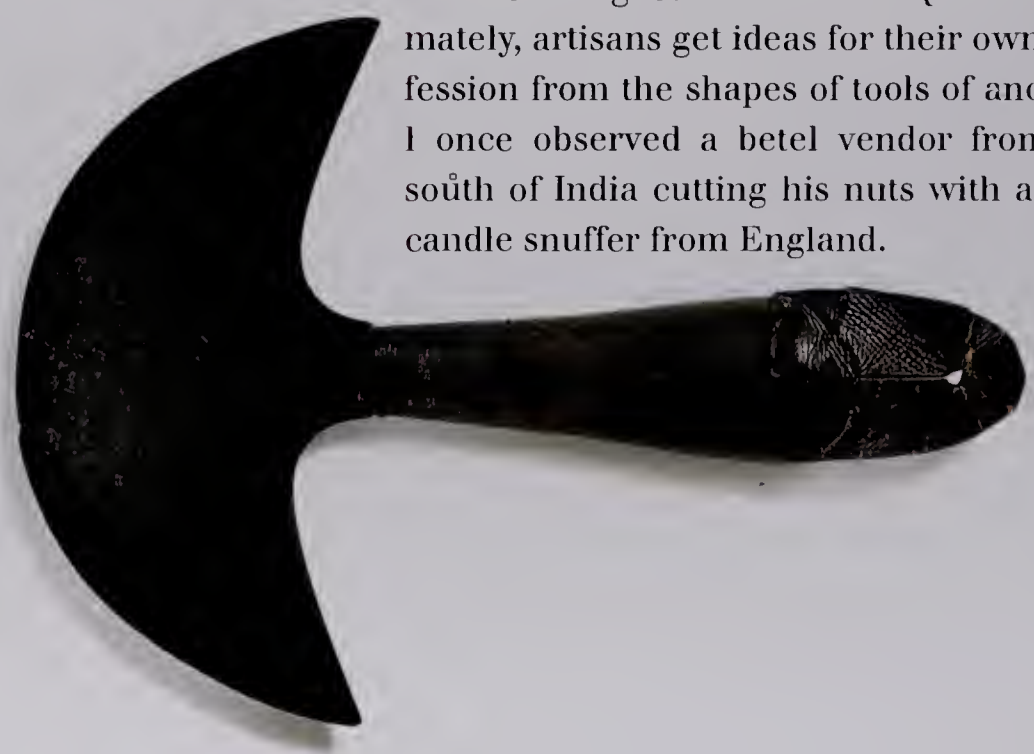
Top: **Eskimo women's knife for scraping hides.**

Center: **Indonesian rice sickle.**

Bottom: **Saddlemaker's knife. France.**

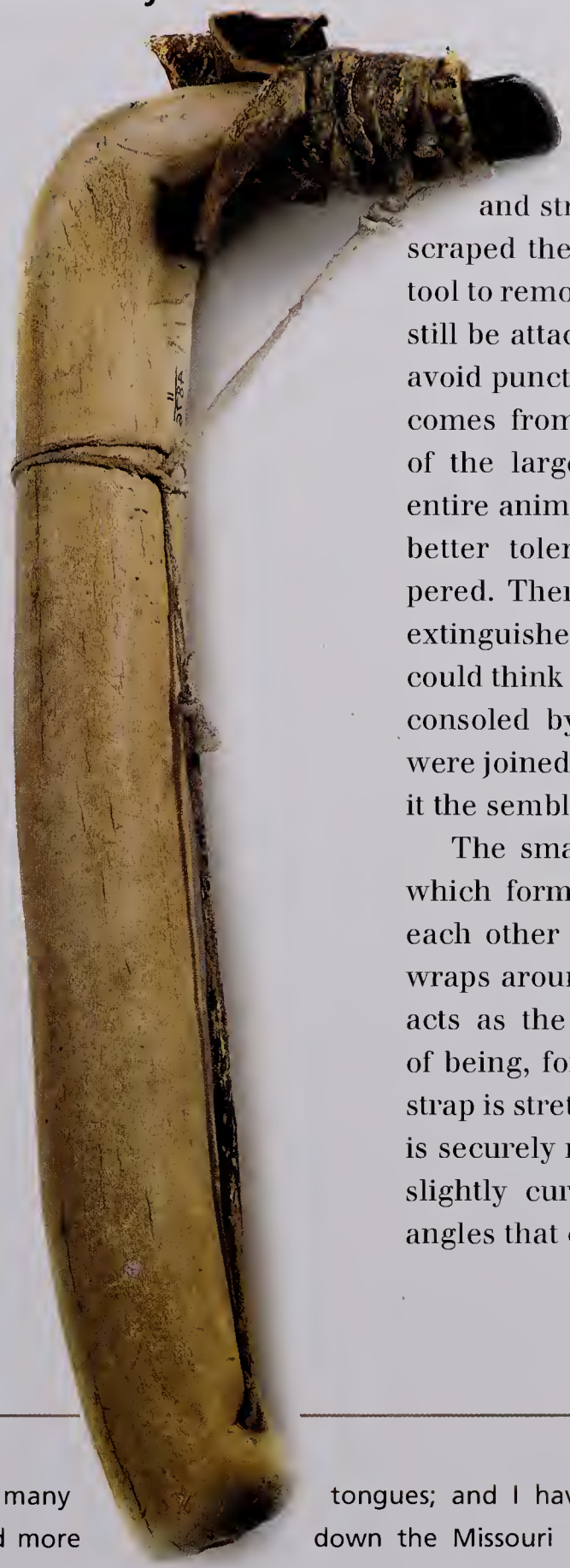
The straight-based knife is a European tool (right) used to cut leather; it is sharpened like a razor. Its handle has a small leather buttonhole for hanging it, which immediately indicates that it belongs to a saddlemaker.

The knife with a T-shaped handle (top) is used by Eskimo women to scrape the sealskins used to make clothes. The responsibility is important and serious, for a hole in an anorak or any other article of clothing might mean that a hunter would drown if his kayak capsized.



Tool for Scraping Hides

NORTH AMERICA **Sioux Indians. Nineteenth century.**



Like the circle of a wheel around its hub, certain cultures are powerfully centered around a living being, animal or plant. Eskimos have the seal; Lapps, the reindeer; Mongolians, the horse; Asians, rice; Mediterraneans, the olive tree.

For the Sioux, it was the buffalo, that enormous bovine whose resemblance to a mythological monster was to be captured by Picasso, inspiring his Minotaur imagery. Through documentary films and amateur videos, zoos, and animal reintroductions, we are quite familiar with the huge quadrupeds, whether they're stampeding blindly in giant herds or wandering aimlessly in peace.

Native North Americans, considering themselves truly immersed in nature and one with all creatures, would select only the buffalo they needed from the herd. Everything—meat, fat, bone, leather, horns, tendons, intestines—was treated, preserved, and used. Thus their buffalo hunting was a remarkable example of good management and resourcefulness. (We are reminded of Europeans and their deliberate and total use of the pig.)

Native American tepees were made of prepared buffalo skin. Once the animal was skinned, the hide was laid on the ground and stretched between stakes. Women scraped the flesh side of the skin with this tool to remove all the bits of meat that might still be attached. This was done carefully to avoid puncturing the leather. The tool itself comes from the buffalo; its handle is one of the large animal's bones. Because the entire animal was used, the killing could be better tolerated. Its harshness was tempered. There was no waste; a life was not extinguished on a whim. Paradoxically, one could think that the animal's spirit would be consoled by the fact that two of its parts were joined together, recomposing it, giving it the semblance of life once again.

The small metal blade and the handle, which form a right angle, are attached to each other with a leather strap. The strap wraps around a mass of folded leather that acts as the bone scraper's buffer. Instead of being, for example, knotted or split, the strap is stretched down the handle, and thus is securely moored. The end of the blade is slightly curved. There are no protruding angles that could tear the leather.

I can remember when the bison were so many that they could not be counted, but more and more Wasichus came to kill them until there were only heaps of bones scattered where they used to be. The Wasichus did not kill them to eat; they killed them for the metal that drives them crazy, and they took only the hides to sell. Sometimes they did not even take the hides, only the tongues; and I have heard that fire-boats came down the Missouri River loaded with dried bison tongues. You can see that the men who did this were crazy. Sometimes they did not even take the tongues; they just killed and killed because they liked to do that. When we hunted bison, we killed only what we needed.

Black Elk, Sioux chief

FOOD

The Pestle

Yet another tool with an indispensable other half, like the hammer and the anvil, the ax and the block, the pestle calls its mortar. The pestle aims to grind grain—or meat, fish, or other food—in the mortar; in other words, to make flour, which can then be used to prepare baby food, flat cakes, or bread.

The mortar-pestle pair is hugely diverse, first, in material. The pestle is most often made of hard wood, but the ones used by pharmacists and chemists can be made of copper or glazed ceramic. In Africa, mortars are made of hard wood, while the standard European mortar is made of stone; those used to grind sugar or salt were hewn from turned wood, those for preparing aioli, from glazed clay. When they were specialized in such a way, they were made to resist oil and odors.

They also exist in a variety of shapes and sizes. African women will endlessly grind millet in cylindrical mortars by raising and dropping a heavy, long cylindrical wood piece about the height of a person. The pestle relies on its weight. European mortars traditionally are shaped like a tapered bowl and are often equipped with two or four handles which allow them to be held in one hand, and there is often a spout for pouring. Others have lateral handles (brass or bronze) or are perfectly smooth and shaped like a goblet. Some metal mortars were finished with a lathe and decorated with thin lines around their circumference. Often, cast-bronze mortars bear the name of their owner, a date, or other adornment. Such a mortar is portable and rests on a table while its pestle is worked with only a single hand.

Opposite: **African women grinding millet.**

Overleaf: **Making flour on a slanted stone.**

Grinding has traditionally been performed by women. In Mexico, where corn is deified, workers sit on their knees and roll a stone cylinder on a slab of stone called a metate. Archeologists have found several ancient metates, which now reside in museums on both sides of the Atlantic. Some are decorated with feline or other animal heads, and others are shaped into jaguar bodies: four clawed paws support the hollowed curve of the slab, which is capped by a feline's head. Even if one claims that these are purely decorative elements, it's not out of line to think that the worker would turn to the jaguar for help and protection.

The shape of the mortar is so distinct that since the fifteenth century the French word *mortier* has been used to designate a very short gun, and since the seventeenth century, a judge's toque. In an identical case of borrowing, the word for pestle in French *(pilon)* is the name given to poultry drumsticks because of their club shape, narrow on one end and bulbous on the other.

Breadmaking

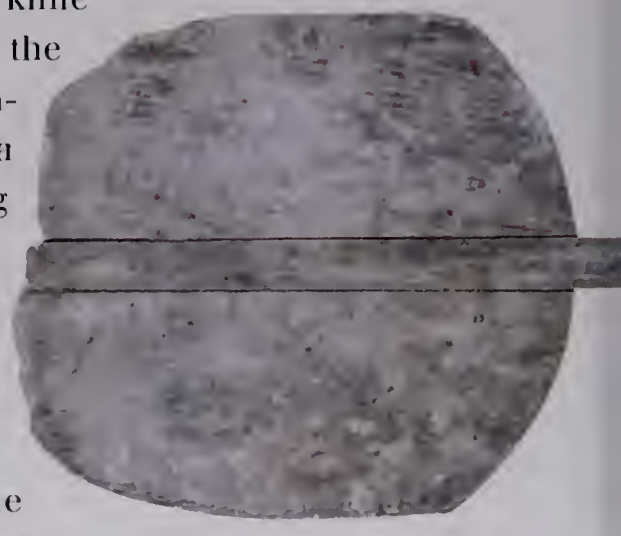
Since trades have a long history, they have taken on personalities; the artisan has a work style and a penchant for certain materials. It is therefore not surprising that the tools of a profession seem related. Out of necessity, one will see more iron than wood in a blacksmith's shop, where fire is omnipresent. The clogmaker's limited array gives the impression of debonair, polished weight. In the cooper's studio, one can feel the constant demand for precision and proper regulation which alone will ensure that a barrel is watertight. On a mechanic's wall, the screwdrivers and wrenches are lined up according to size, and their outlines are drawn on the wall so that it's easy to see which tools are missing. The cabinetmaker uses gouges and chisels with oblique handles to assure a better grip. All are slightly different; they seem to be neighbors in the shed, the same individual stated differently. A tool with a short, round handle and a small leather tab with a buttonhole in the middle is immediately recognizable as the cobbler's burin.

Because of the oven's size, the few tools the baker uses are distinguished by their long handles, which are uniquely solid. The bread shovel is an example. Nothing is decorative; nobody enters the baker's sanctuary. The branch was taken from a tree and still bears its bark. It doesn't matter if it is twisted or straight, as long as it has the proper diameter and length.

A ferrule connects the dough scraper—the large tool used to remove the remains of the dough once the bread has been baked—to its handle. The handle might be wrapped on one end with rags, tied up to make a swab (with the same shape as the one belonging to artillery men long ago). This will clean out the ashes remaining on the oven's bricks.

Before putting the dough in the oven, the baker will throw in a fistful of flour. If it burns, the oven will have to be cooled with a wet cloth.

There are two handheld tools always within the baker's reach. The pastry knife is used to remove excess dough from the kneading bowl. It is a small tool, completely made of iron and shaped like a hook. It is wider at the end and has a ring that it is hung on so it won't get lost.



A simple, well-sharpened kitchen knife is used to cut decorative slits on round loaves and French baguettes. These slits are not intended simply to please the eye; they also allow the release of pressure as the dough expands.

The household oven: a covered oval mud receptacle filled with embers.

BAKER'S BREAD SHOVEL

It's a pallet, flat and long, with rounded edges, and attached to a very long handle (some can extend for more than nine feet). It is used to rest the dough ball on the oven surface. A hot fire preheats the oven, while the dough rises in a basket covered with canvas. Through practice, one learns how much wood is needed to attain the necessary temperature. When the wood has been completely burned, the baker or an assistant will remove the ashes and old embers from the oven using a metal scraper. Once it is cleared out, the baker inserts the dough on its shovel deep into the cavity, and, in one fell swoop, pulls out the wood plate from underneath the bread to be baked. Thus the baker will place the round loaves in the oven from the back to the front until it is time to close the door to let them cook.

A similar but shorter tool is used by pizza makers to place pizzas in a much-smaller oven. Pizzas cook quickly, and only a couple are put in the oven at once. Unlike the baker's oven, pizza ovens shelter a fire that is constantly maintained.

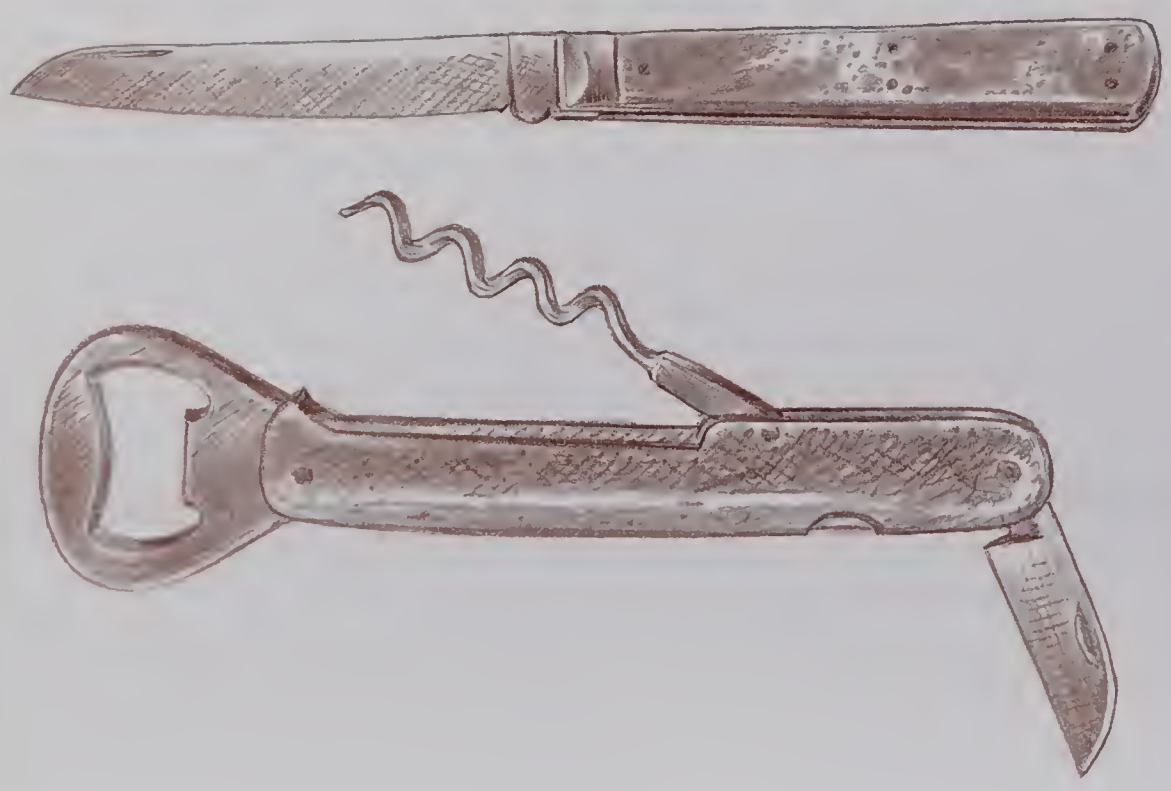
In Egypt, Lebanon, Iran, and elsewhere, ember- and log-filled ovens are large earthenware jugs. The bread is flat and either round or long. The loaves are golden, covered with large air bubbles, and are folded and carried under the customer's arm, like a piece of clothing. The shovel used to flatten the dough against the oven wall and remove it when it is cooked is the hand of the artisan.

Knife

"A sailor without a knife is like a boat without a barrel," says the old sailor's adage. What madness, what an unthinkable plan it would be to set sail without both. Throughout the day on board, sailors need to cut rope, splice it (their knives would have a blade and a bodkin), cut into the canvas of the sail, shave chewing tobacco, slice bread and meat, and during the rare moments of rest or inactivity, use this same tool to carve bone, walrus ivory, or wood into objects that could be sold at a port or offered to dear ones upon their return.

Who could deny it? Users of knives are everywhere: shepherds, isolated for long periods; farmers, constantly encountering small maintenance and repair jobs on top of the seasonal tasks; carters and their distant comrades, caravanners; café or restaurant waiters, who always have their knife/bottle opener/can opener at their fingertips; writers of days gone by, who sharpened and resharpened their goose quills, as Chinese scribes and draftsmen did with their bamboo reeds; graphic artists, who regularly use cutters, a recent development in the evolution of knives which, instead of being sharpened, contain a reserve of blades that snap off; and schoolchildren from the city or the country, who dream of owning a knife after only seeing one at work and will go get a used one for the pleasure of it.

A person with a knife has highly symbolic powers. He or she can take control of the surrounding world, slice it, divide it forever. These gestures entail risks, however, the danger of wounding, cutting the skin of the other hand with an unexpected turn of the blade. Sometimes what's being cut will resist the edge, and the knife user will give it a strong push, exert, struggle, forget what he or she is doing. Suddenly, in a surprise victory, the knife meets flesh. It might also happen that, impatient to complete the task, the worker could seriously nick the object being shaped. When this happens, everything will have to be started over again; the task that was once completed successfully is now lost. But a lesson has been learned. An experience lingers. From beginning to end, the artisan will have to use steadier movements, with great care, and the fact that the job is almost complete should not be a factor. Quite the opposite—as it is through impatience that one runs the risk of being clumsy.



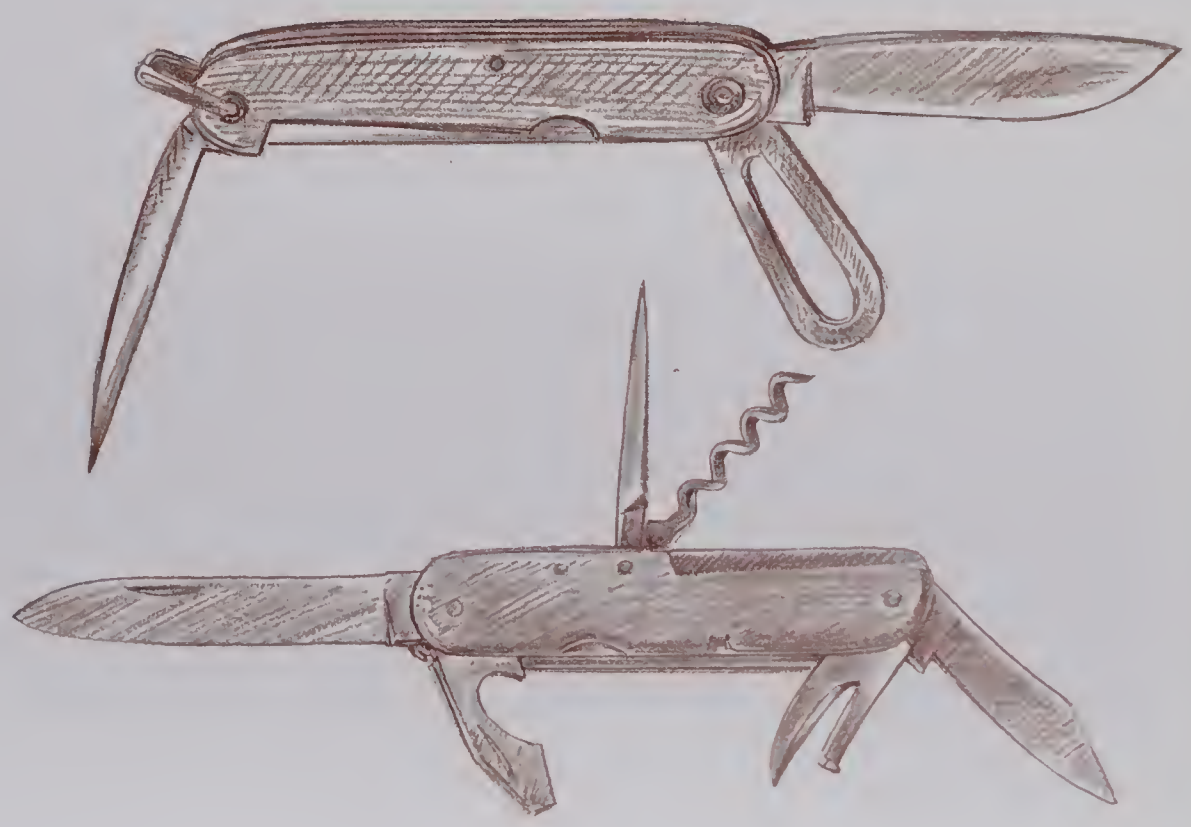
A pocketknife and a waiter's bottle opener/can opener with a blade.

It is certain that the knife gives its user conquering power over surrounding matter, but it offers more—freedom when used expertly. One wonders what would happen if a Robinson Crusoe were to lose his knife on a desert island. It would be the end.

The knife is indeed a tool with multiple uses. With a back-and-forth movement, it will cut like a saw; pushed down, its horizontal blade will slice something soft or will split a piece of wood; both the fisherman and the cook will scrape it side to side to remove scales or vegetable peel; by pivoting its tip on wood, one can make a hole; a wide blade can be the perfect lever, whether to separate an oyster's two valves or lift a board; taken in both hands and pulled toward the body, the knife can be used to plane. This is what clogmakers do with their double-handled planes, what shepherds do to make their sticks, and what some artisans do to make their tool handles. It is with a knife that farmers will arm themselves to sacrifice fowl. Knives even provide the metal with which the blade of another knife is sharpened. And we haven't mentioned when knives become a threat and are waved about when an argument has crossed the line and turned into insult.

The knife remembers that it was once a weapon. The pocketknife, used to cut and pierce, is a miniaturized, tamed, harmless descendant of the ferocious, threatening dagger. Looking at blades of sharpened flint, who could distinguish a household knife from a dagger-like weapon? And we can only imagine what handles they were given. The same object was used for combat and hunting, for cutting meat and skin, and for making a hunting spear. Essentially, no matter its shape, the knife has helped fight the battle of life, whether pointed like a claw or sharp like an animal's tooth.

With the invention of metal, the dagger's shape was developed and made more solid —albeit slender and long—and it allowed for the corresponding full movement. The knife was not going to disappear because of the dagger's emergence, nor would it remain in the house. The dagger could not meet every need because its weight and size rendered small tasks difficult to accomplish. Like the dagger in its sheath, the knife was slid into a case and placed in a pocket or attached to a belt by a strap.



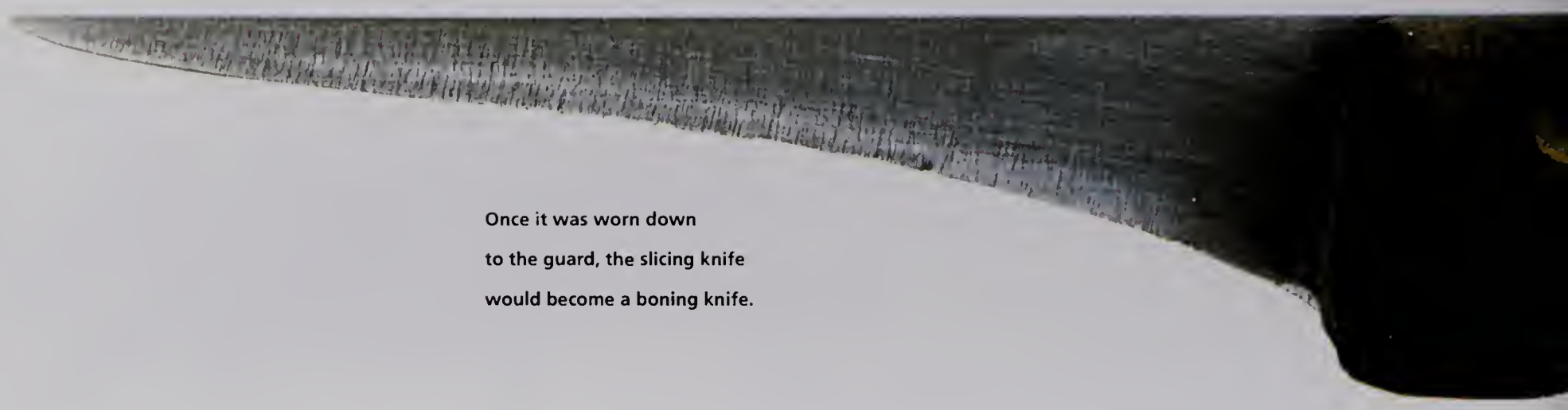
A sailor's knife with a splicer, and a six-blade Swiss Army knife.

A jackknife from Spain.

The knife known as the table knife is a very common object, a cross section of traditional and technical evolution. First and foremost, it is a personal object, which in France, until the end of the sixteenth century, was taken to dinner in the city. In the mid-seventeenth century, it still had a point and served as a fork to stab meat and bring it to the mouth. At the end of the seventeenth century, it folded, which enabled the knife owner to dispense with its case. The tool was now half the size, and its tip and cutting edge were covered. Nevertheless, certain details will never slip by those in power. In 1669, Cardinal Richelieu handed down an edict requiring knife owners throughout the kingdom to use knives with rounded tips.

The difference between a knife and dagger can be unclear. The jackknife is indeed a pocketknife that can be used when eating, but, because its blade can be locked by a catch in the handle's axis, shouldn't it be considered a weapon? The locking jackknife is only good for slashing an attacker's hand. It was not uncommon for legislators or police to decree that the length of the blade must not be longer than the width of the hand. Everything is subject to circumstance.

In the legends and traditions of numerous countries, the knife is justly exalted. These words of wisdom are often didactic: take care of your knife; it is a friend, a precious companion; do not lose it; maintain it; it will



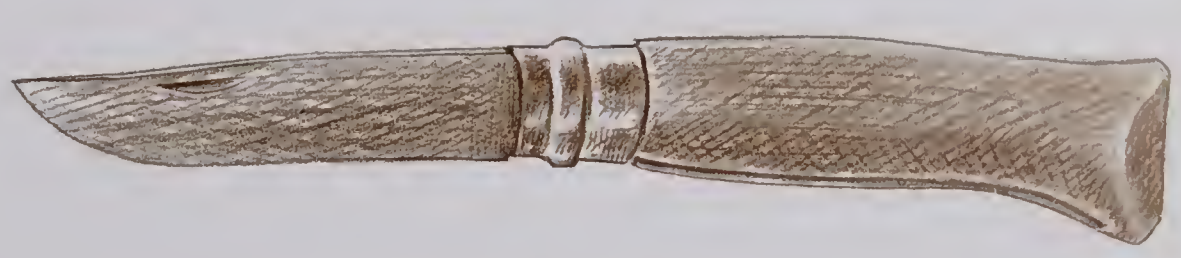
Once it was worn down to the guard, the slicing knife would become a boning knife.

prove to be a good servant giving back a hundredfold what you give it.

In ancient China, one of the first copper coins was shaped like a knife.

Because the knife belongs to the family of instruments and cutting tools, French custom has it that a person who offers a knife should be compensated with a gift of a coin, even if it is not worth much. Thus the bonds of friendship will not be severed.

In many countries, owning a knife marks a child's passage into adolescence. It is also sometimes the requirement for belonging to the virile, masculine world. The knives of Senegalese prisoners during World War II were confiscated. With a bit of ingenuity, it did not take them long to make new ones, symbolic as they may have been: a shard of glass, the top of a tin can, with enough of a handle to show affiliations and save face.



The twisting ferrule of the famous Opinel knife will lock the blade in place.

THE BUTCHER'S KNIFE

When butchers sharpen their knives, it's as quiet as an actor taking in a breath. The sharpening steel, this hard steel cylinder striated down its length, never leaves their belt or block. It follows the knife as relentlessly as would its shadow. The blade must cut like a razor, so once butchers have used a knife a half-dozen times, they quickly, almost automatically, run the cutting edge of the blade over the steel, two times on each side. The customer will have barely had the time to see it happen. The artisan works without looking—he doesn't need to—and often continues to chat with the customer. It's like a break between two tasks.

All too often we forget about this action. We observe it and don't think about the preparation, the intervals. Just like reapers need their sharpening stone, the butchers need their steel. The blade's beveled edge must constantly be maintained, straightened, refined. This is why a good blade will be worn down as far as it will go.

Whaler's Knife

AZORES

Among its large exhibits and various kinds of boats, the Maritime Museum in Lisbon showcases the rowboats used by fearless whale hunters. A visitor stands mesmerized before the small size of these dinghies. Larger boats would tow them to where the fishing was to take place. The oarsmen would approach the mammals with harpoon in hand. After the adventures that preceded the capture of the sea animal —which sometimes included mounting the whale's back and a boat capsized in the waves—the enormous mass was hauled on board the flagship. The fishermen would then get to work, turning into butchers.

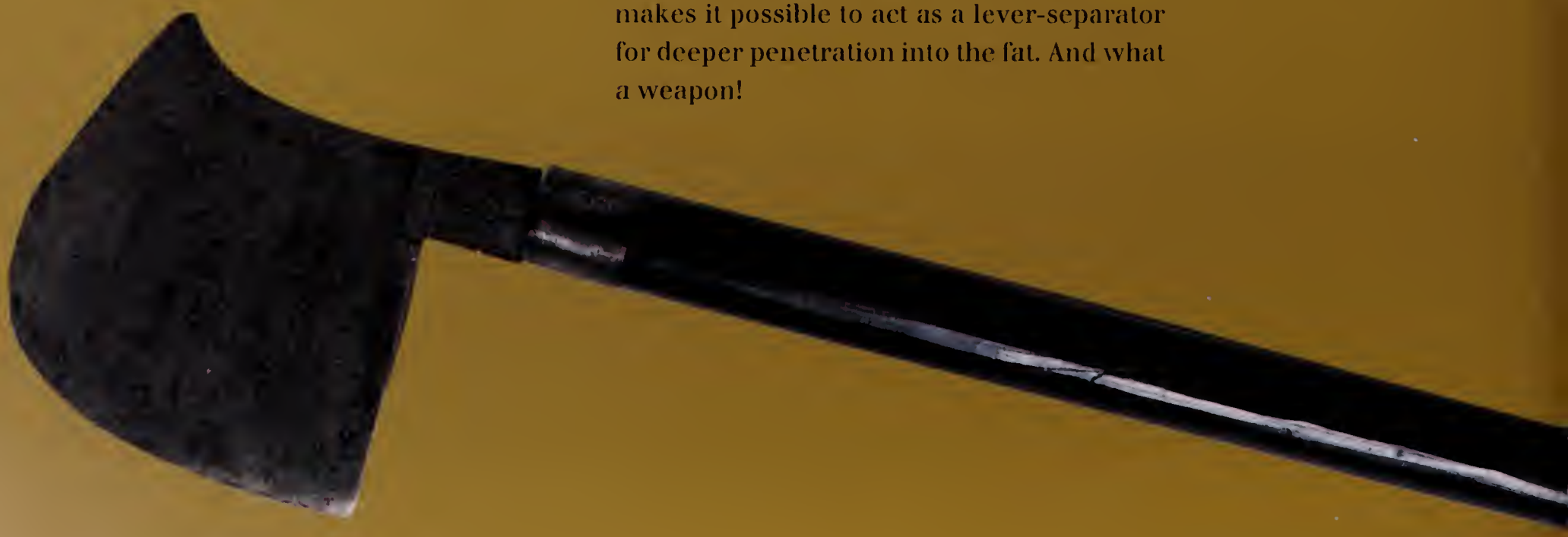
The thick skin would be slit and lifted in order to reach the precious blubber layer. The fat, which was quite firm, was cut into big cubes and tossed into large pans set over a raging fire. The oil was collected, dripping into barrels that were then stocked in the hold.

Certain parts of the meat were kept, and the precious whalebone (used to make the well-known corset stays and umbrella ribs) were extracted. The carcass was then thrown into the sea.

The shape of this knife is remarkably well adapted to its function—cutting blubber. Its relatively long handle allows for a deep incision into the mass. The blade is shaped like a quarter circle and is very sharp. It is just as effective when used vertically, from top to bottom, as it is when pulled toward the body. The blade's finesse makes the tool light and manageable while its width makes it possible to act as a lever-separator for deeper penetration into the fat. And what a weapon!

This elegant blade is used to cut whale blubber into cubes.

Opposite: **This tool is used to release honey from the cells by cutting their seal.**



Honeycomb Knife

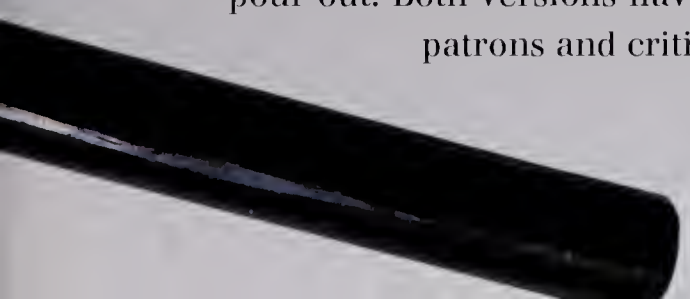
The operculum is the light wax seal with which bees coat the honey-filled cells to close them and protect their reserve from possible intruders.

Come high season—toward the end of summer, depending on the region—beekeepers, clad in mask and gloves, will remove the honeycombs from the beehive. They will return to their workplace with these splendors of economical architecture and perfect geometry in order to extract the precious sweet liquid. This entails cutting the sealing to release the honey. To perform this job, beekeepers in the south of France, the land of sun and therefore of flowers and bees, use a tool that has undergone an interesting evolution.

The oldest example is a simple iron rod with a square cross section, forged by the village blacksmith. Its two ends were flattened and sharpened, and one was hammered into a right angle. With it beekeepers could cut head-on or scrape. The rod would be slightly wider in the middle, enabling the beekeeper to hold it properly in hand.

In the next phase, the honeycomb knife came into existence. It looks like a long trowel, the blade of which is shaped like a laurel leaf. The side of the blade is equipped with sharpened teeth shaped like crescent moons.

Later beekeepers sought to improve the tool, and in particular, to find a way to keep wax bits from getting into the honey. They asked the tinker or tinsmith for help. The refined object has the same shape as its predecessor, but the blade has become a hollow copper reservoir which can be filled with steam through the tubular handle, thus melting the wax and causing the honey to pour out. Both versions have their patrons and critics.



Tibetan Knife

The oddest of tools, its construction—consisting of the most rustic of blades and a tiger's tooth for a handle—is certain to intrigue. It reveals the mindset of its maker, for successful hunters will keep one at their side and can show everyone the trophy symbolizing their courage and skill. Totemic belief also guides the making of this object: the tool's user is sure to borrow some of the enormous cat's strength when using the knife.

Something else must be said regarding the size of the blade, which is small because metal is rare in these parts: it is quite adequate for a good number of daily tasks, cutting leather, for example. Often, one will observe that only a small fraction of a knife's blade is used.

Vegetable Peeler

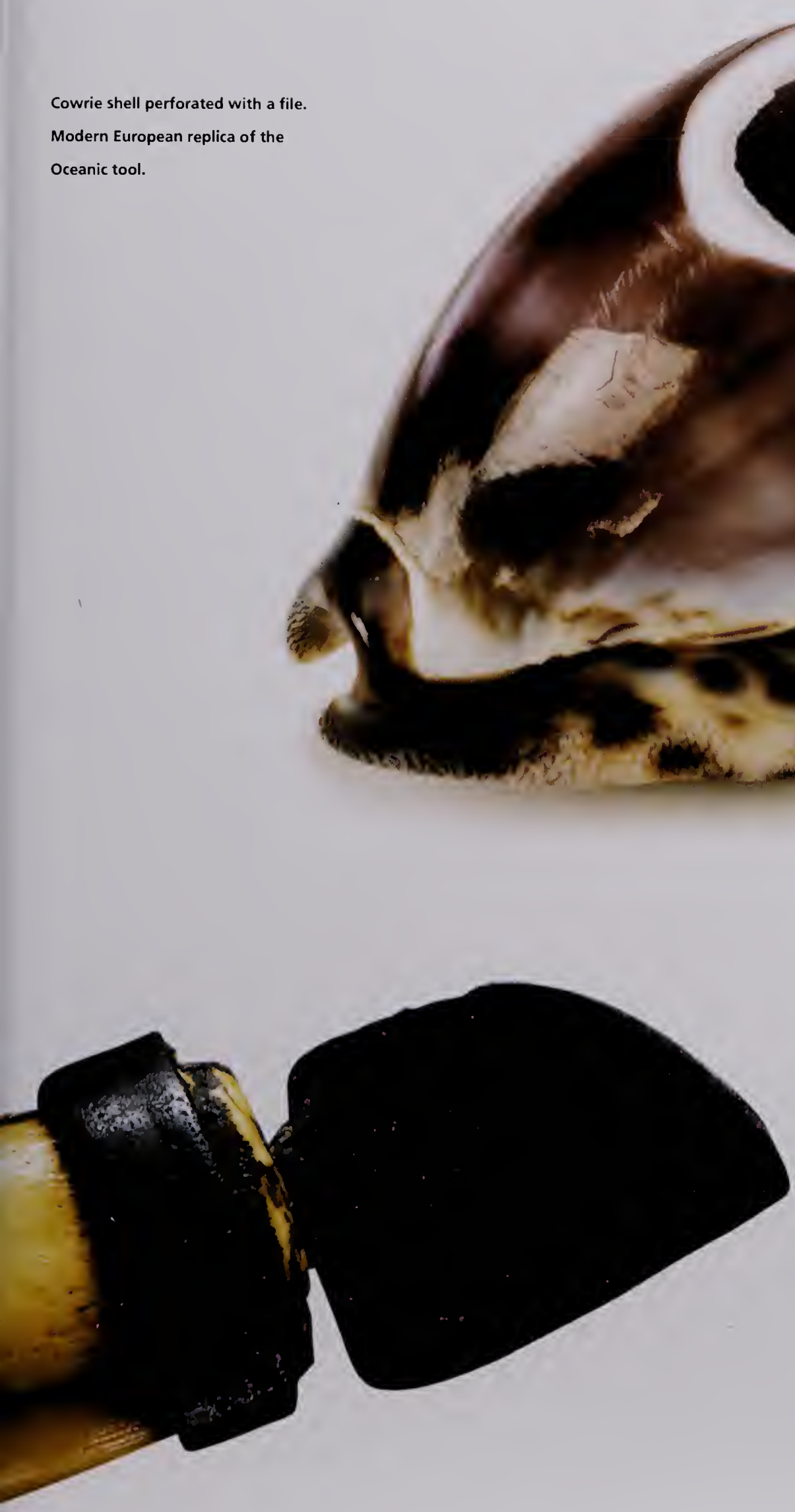
OCEANIA

A ship is an island. On it there is only what was brought. The voyager—and the shipwrecked—find what the ground has produced, what the climate will allow, and what the waves bring to the beaches. The comparison continues; on board a ship one will learn—on the job—how to be resourceful. Problems must be solved with what is available.

The cook always has some vegetables to peel. A knife can be used, provided that it is perfectly sharp, but this is dangerous for the hand holding the vegetable. Continuous mindfulness is required. Sometimes the peeling will be too thin and narrow. In this case the work will be slow. Sometimes the peelings will be wide and deep, in which case food is wasted. The ideal tool for the job is the commercially available vegetable peeler. The thickness of the slice is determined by the space separating the blade from its guide.

Nature's prestigious gift used to make a tool.

Cowrie shell perforated with a file.
Modern European replica of the
Oceanic tool.



One wonders how the indigenous people of Oceania peeled their vegetables. They took something from their environment, a metal equivalent: that odd, hard material produced by animals that is also likely to be sharp—the shell. They chose a cowrie shell, the shape of which is similar to a fruit. It can be easily held, and its weight allows for accurate work. By rubbing it on a rough stone, people would wear it down and cut an oval opening on its side. The shell's edges are naturally sharp because they are beveled; and because they are separated by a narrow space, one side will act as a guide to the other. It's like the plane in principle. The islanders of Oceania skillfully work this tool, occasionally shaking it out to empty it of its peels. This moment, in which the work's monotony is broken, is welcome.

Handling Tools: The Forbidden and the Privilege

No matter where we are from, we tell our descendants of the creation of the world, prepare them for life with knowledge, feed them, protect them, and defend them. Thus, generations are linked together like a chain. There are conditions, however, for what is passed down. Relatives and community consider age and capacity, and sometimes perform certain ceremonies for those about to change social ranking. Ethnologist Arnold van Gennep studied these moments in life throughout various civilizations and unveiled the existence of rites of passage. One would be mistaken to think that these ceremonies abound among certain peoples and are nonexistent among others. Brazilian Indians would apply wicker pieces infested with ferocious flesh-eating ants onto the skin of the young members of the dreaded tribe. Of course, not all examples are as disturbing; nor are they as intimidating as the one practiced by certain African tribes in which one is made to survive on one's own in the hostile forest. There are many kinds.

Because tools are sharp, pointed, or simply heavy and are therefore considered dangerous, handling them requires strength and the in-depth instruction provided by apprenticeship. Tools will therefore, of course, be strictly and completely prohibited for a certain time—that is, early childhood. It will become harder and harder to enforce this rule on a growing child, however, first and foremost because childhood is a time of absolute curiosity and enthusiasm; second, because a child is not satisfied with looking. He or she needs to touch, hold, handle, experiment, and test the tool him- or herself. The hand and mind are irresistibly attracted to the tool. The polished handles call to the hand. The shapes evoke movement and action. Far from appearing dangerous, tools seem to be tranquil objects. They seem to magically offer the power they contain to the one who will take them in hand. Like dreams, the imagination will ignore obstacles and improbabilities. Ten-year-old children will picture themselves waving a felling ax; they already hear an oak tree falling, and proudly relish their victory. The similarity between tools and weapons (the ax, for one; the knife is the dagger's twin; the hammer or the chisel can kill) adds another dimension to tools' desirability, though it may not be clear: the dream of finally crossing the frontier between child and adult, even if only partially or for a limited time. How many times will the son of an artisan or farmer, who will have grumbled, complaining about how slowly time passes, be told: "Tools are not to be touched. . . . When you're older." In the boy's eyes, having tools and

weapons at his disposal will make him a man among men who work, conquer the material world, go to war, and hunt.

We won't be able to resist the children's relentless insistence for long, for we adults remember our own youth. It starts with a lesson. We teach them how to recognize the shapes and how to designate objects by their names. The moment to hold will arrive (with permission from and in the presence of the tool's master), and will soon be followed by some participation—it's just a little start. The child will bring the requested mallet to the workbench and will give the plane a push—the plane is known not to be dangerous—first over an unwanted piece of wood, and then over a "real" board that is being worked. The chances of ruining the job are slim. Hammering a nail is a simple and educational exercise, for if there is any haste or loss of concentration, the child's fingers will receive a blow. Still taken aback by the nice hammer's betrayal, the child will hear those famous words for the first time, "You're 'pounding in the profession.'" After having received help using various tools, the apprentice will brave them alone.

Coming as a complete surprise, or as the fulfillment of a longtime promise, the child will receive—often on his seventh birthday, the age of reason—a knife of his very own. The elegant penknife, the rustic Opinel, or the handsome Laguiole, or the all-purpose six-bladed Swiss Army knife symbolizes how the young owner has been trusted to be careful, serious, and dexterous. It is his daily companion. Carrying a knife at all times will become habit, perhaps for the rest of his life. It's a new existence in which the hand will become more efficient, in which possibilities are opened, leading to other dreams of building. With the knife, the world of skill is ready to be conquered. A rite of passage. To appease children's passion for tools, or to give them a love for working with their hands, we sometimes offer them a gardening or carpentry set that include the trade's basic tools in miniature. On farms, it was common to see women's tools hanging on a wall next to the men's. There were sickles, hatchets, and pruning knives, which because they were smaller, were not as heavy.

Properly adapting tools to the physique of the worker answered one's wish to have one's own tools; they were for no one else. We often hear that a scythe, billhook, or ax are not things to be lent out. And it is quite possible that the size or weight of a certain tool may have been increased on purpose to add to its power—and to discourage possible weaker and younger borrowers.

Coconut Grater

TANZANIA. TWENTIETH CENTURY

So as not to lose them, some will color their tools. The owner of this African grater chose to decorate it instead.

The machete's blade will split the coconut in half, into two hemispheres. The edible part, which is solidly attached to the wooden peel, will then need to be grated. Since one does not want to remove large chunks, but rather fine white shavings, one will use a grater. The blade is oval in shape, and its circumference is embellished with small teeth.

Is the tool handheld? Absolutely not. African workers have chosen to use both hands to hold the coconut. Therefore, instead of working the tool inside the wooden half-sphere, they bring the concave surface of the shell down to the tool, which remains immobile. Workers draw on all the strength of their arms as well as the adept mobility of their two hands. By reversing the operation—by keeping the shell immobile, instead of the tool that works it—the effect is more efficient, yielding more coconut, of course. The worker must steady and stabilize the tool. Something must resist the thrust of the hands, like a buffer. What better than a sizable weight? A very large stone or the trunk of a tree will do, but then the tool and its counterweight might not be portable; and one might want to work in the breeze, in the shade or next to a pile of coconuts. Why not use the weight of a farmer's body—male or female—to weigh the tool down, as something like a base? Indeed. And when one thinks about a base, in the case of humans, one is reminded of a chair. The process has reached its end: a good idea has been found. The coconut grater will be attached, like a figurehead, on a solid, light stool that can be put in the place of choice. Another advantage is that the person who would like to work won't have to head in two different directions to get the tool and a chair, since they are attached. The two are inseparable.

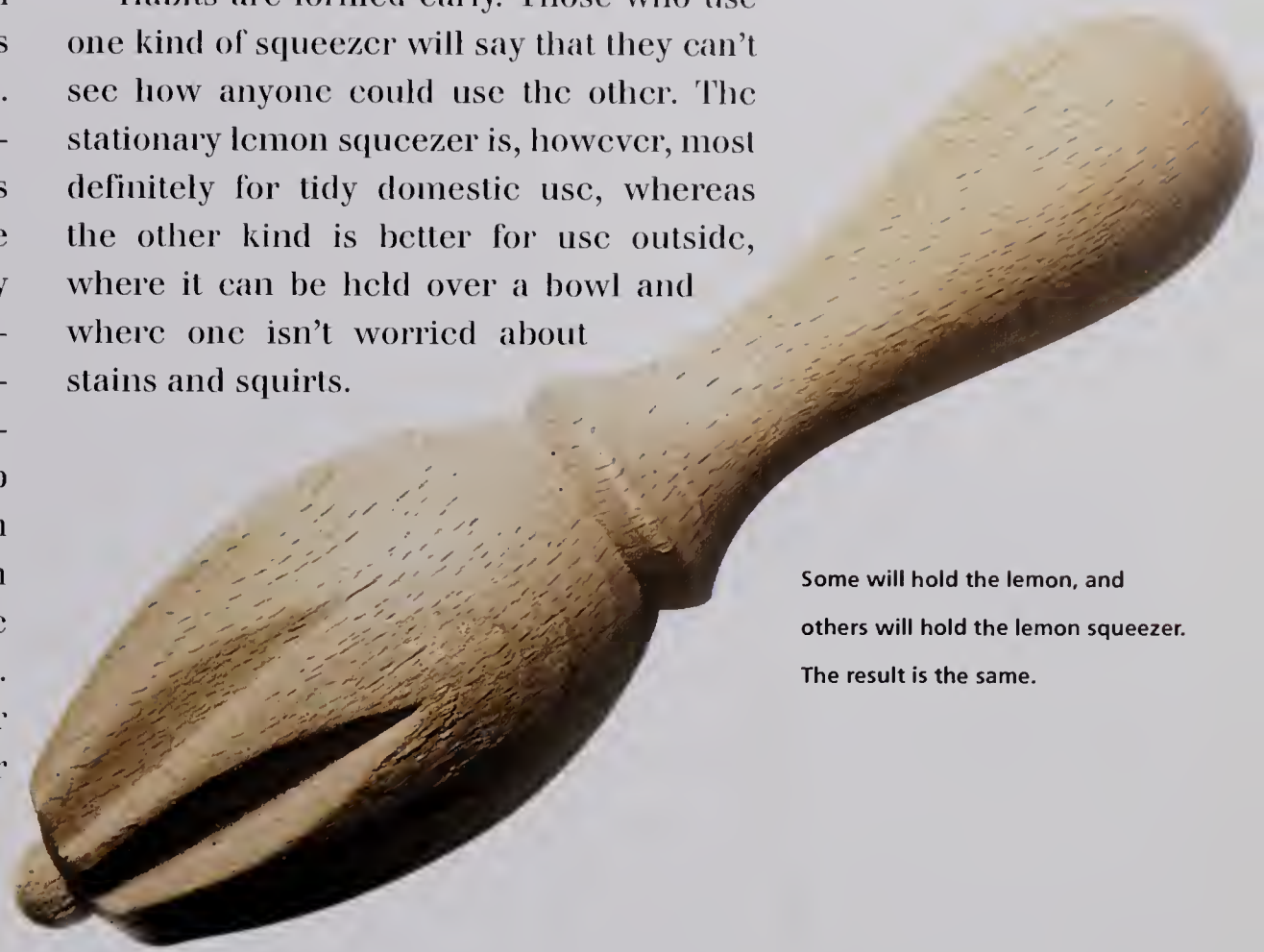
Why would the chain of inventions, combinations, improvements, and conveniences stop here? The chair could take up less space if it could fold, for example. Therefore, why not borrow from the X-shaped lecterns used by devout Muslims to read the Koran? The apparatus is hewn from a single block and split down the center through the thickest part on both ends. The carpenter added a hinge to the central part. The tool–folding chair was invented.

Lemon Squeezer

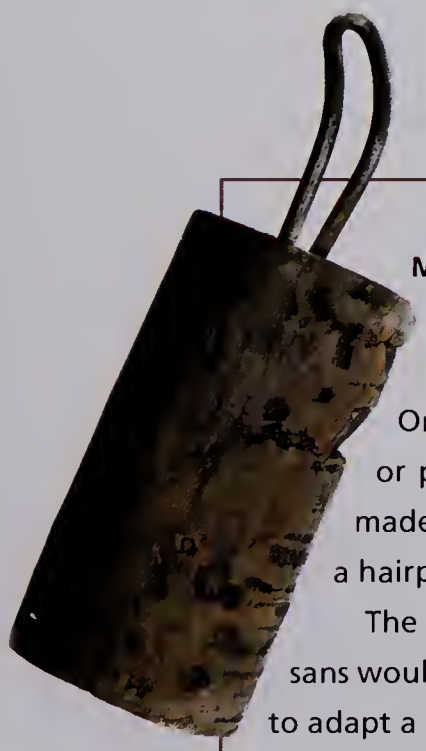
FRANCE AND THE MEDITERRANEAN

We are immediately familiar with this tool upon first glance, for its shape, at least part of it, is not unknown. Its artillery-shell profile and its rounded-cone shape divided into sharpened ribs is the lemon squeezer as we know it, made of glass or porcelain and permanently attached to a spouted saucer. This one, having the same purpose, is extended by a handle. It is set into action rather than remaining still. The tool is turned and scraped deep inside a lemon or orange that has been sliced in half, whereas in the classic lemon squeezer, it is the fruit that is pressed. The latter does a more thorough, complete job. With teeth at the bottom of the cone, or with holes in the dish, the juice will filter through, and the pits will be strained out.

Habits are formed early. Those who use one kind of squeezer will say that they can't see how anyone could use the other. The stationary lemon squeezer is, however, most definitely for tidy domestic use, whereas the other kind is better for use outside, where it can be held over a bowl and where one isn't worried about stains and squirts.



Some will hold the lemon, and others will hold the lemon squeezer. The result is the same.



MAKING SOMETHING OUT OF NOTHING

On the market there is, of course, a tiny ladle-like spoon used to pit cherries. One would think that it didn't suit a particular expert pastry chef from Beaujolais; or perhaps it damaged the fruit. Using what was available, the resourceful man made what he needed from a wine-bottle cork and a wire bent into the shape of a hairpin.

The story of this object fits into a long tradition. During their apprenticeships, artisans would indeed learn to make their own tools. Perhaps it represented the opportunity to adapt a current tool to obtain one that would fit one's hand perfectly.

Sugarloaf Cracker

Over a hundred years ago, in France, sugar was sold in loaves. Sugarloaves were shaped like artillery shells with a rounded top, were wrapped in a spiral of coarse blue-tinted paper, and weighed about two pounds. To use the sugar you had to cut into the solid mass to chip at it and break it up. Many tools were made for this purpose.

A small metal hammer—square on one side and flat on the other—would start the work. Later, the monumental, heavy wrought-iron cracker was introduced. One can note the artistic and technical attention with which it was constructed and finished. The two cutting blades do not touch, which prevents the precious sugar from shooting off; instead, the sugar cracks cleanly. There are a pair of stops located in the middle of each handle half, which ensures that users won't crush their fingers if they get between them. The spring-loaded clasp clearly shows that this is not an object for everyday use. It is a kind of ritual object, a scepter that can be employed only by certain individuals—in a store, it is the head grocer who would use it, and in the home, the head of the family.

It comes as no surprise that the object's size and weight intimidated the curious, limiting its use to those who officiated over the sugar-cracking ritual.

Paradoxically, the cracker was also used—both on occasion and regularly—by professionals such as confectioners, pastry chefs, or even grocers in the retail sugar business.

The best way to get around the problem of handling the heavy cracker is to mount it on a base. To reduce scattering and waste, it can be placed over a box-like container that would catch the bits and pieces of cracked sugar.

The sugar cutter with pedestal was born in the image of other mounted tools, such as the baker's knife or the boilermaker's shears for cutting sheet metal.

In North Africa, where sugar is still sold in loaves (to those who love a few glasses of steaming tea each day), every household will have a little brass hammer and a sugar cracker.

A metal insect with a long body, decorated with mighty mandibles.

Tobacco Cutter

In this case, what is cut is what is kept. The blade is jointed to a receptacle.

Chewing and pipe-smoking tobacco have not always been prepared and packaged in the way we know now. In the past, nicotine enthusiasts would shave their own tobacco for chewing and would slice it into thin strips for smoking in a pipe. Tobacco leaves were available in compressed blocks which were humidified so they wouldn't be brittle.

With its ingenious design, this device serves several functions. A handle allows the cutter's blade to be worked precisely. The grated tobacco is collected in the hollow part, which acts as a receptacle. Consequently, not one shred of the precious leaf is lost. Tobacco was sold by weight. The tobacconist would grasp the handle, which was perpendicular to the blade, and pour the cut leaves through the special spout and onto the scale pan.

One who repeats such a gesture several times in a day will seek ways to adapt it so that it is as easy to perform as possible and so that bits of tobacco won't have to be picked up from the table, for example. Thus, some tools, which required that one raise one's hand to work them, were transformed and given a stand that acted as a container. Sugarloaf crackers underwent the same evolution.

The Future

Tools, the objects we invent to fortify and prolong the action of the human hand and to greatly increase the strength of the arm, will be at our side for eternity. Our common history is far from being over. This is certain. After air, water, and food—all vital necessities—the tool, along with clothing, is the object that is dearest to us; it is what we hold the most in our hand, and what is found most often at our side. We do not exist without tools. The journey of this mediator between project and matter is as long as that of human genetics. From pebble and sharpened flint to the mechanic's pliers of the year 2000, the tool traces a line that is as continuous and precious as the flow of blood through our veins. At all times. The price is life.

One question is raised: where do hand tools stand in the face of the inventions of the modern world? Does describing these tools come down to preparing a postmortem? Does the builder in this age of cement, the blacksmith in this age of the car, the reaper in this age of the squads of combines made in Russia and North America, still exist?

The answer could very well be, "Not here anymore, but beyond." For tools have the capacity to evolve—though they have been replaced by machines in many countries—and they are being taken into space. In modern Europe, everyone can see that along with the artisans who used them, tools belonging to the blacksmith, clogmaker, slater, forge worker, lumberjack, and many others have disappeared. Nevertheless it is useful and interesting to learn how a horse's shoe is made and attached, how a clog is made and hewn, how roofers exert themselves on a roof, and what lumberjacks would think of—their giant tools in hand—

before uttering the well-known cry announcing the fall of the tree.

First and foremost, it is certain that technological knowledge—which affects individual lives as much as a country's economic development—is an integral part of the picture historians attempt to paint. The history of a country, as well as the history of the world, cannot ignore the impact of the technical assets a civilization of a particular time had at its disposal.

On a more simple but very real level is the satisfaction one can take in learning how his or her house or table was made.

Today, in Mexico and Morocco, horses are shod with tools that are stronger than those used a hundred years ago. And if a new rice sickle were to be used across the huge land of China, hundreds of thousands more would be sure to be produced. A tool kit accompanies every motorized vehicle.

Tools are not dead. They're like a phoenix rising from the fire that grows, is adorned, multiplies, and flies!

In European countries, statistics show that tool sales are growing consistently. Think of the sprawling stores and mail-order catalogues. Why? Because all men and women at this end of the twentieth century in Europe have realized that they must become artisans, workers, laborers for their home, car, or country house. This means they need the necessary arsenal of tools for the main jobs, whether for the city, vehicle, or fields. Of course in city residences there is now no longer a woodshed with a block and hatchet,

CONNECTION

While conducting my research, the link between people and tools became increasingly tangible to me. At daybreak in Spain, I could see a team of five reapers carefully pedaling their bicycles on a dirt road. On their shoulders they carried their long scythes, the blades of which reflected the first rays of the sun.

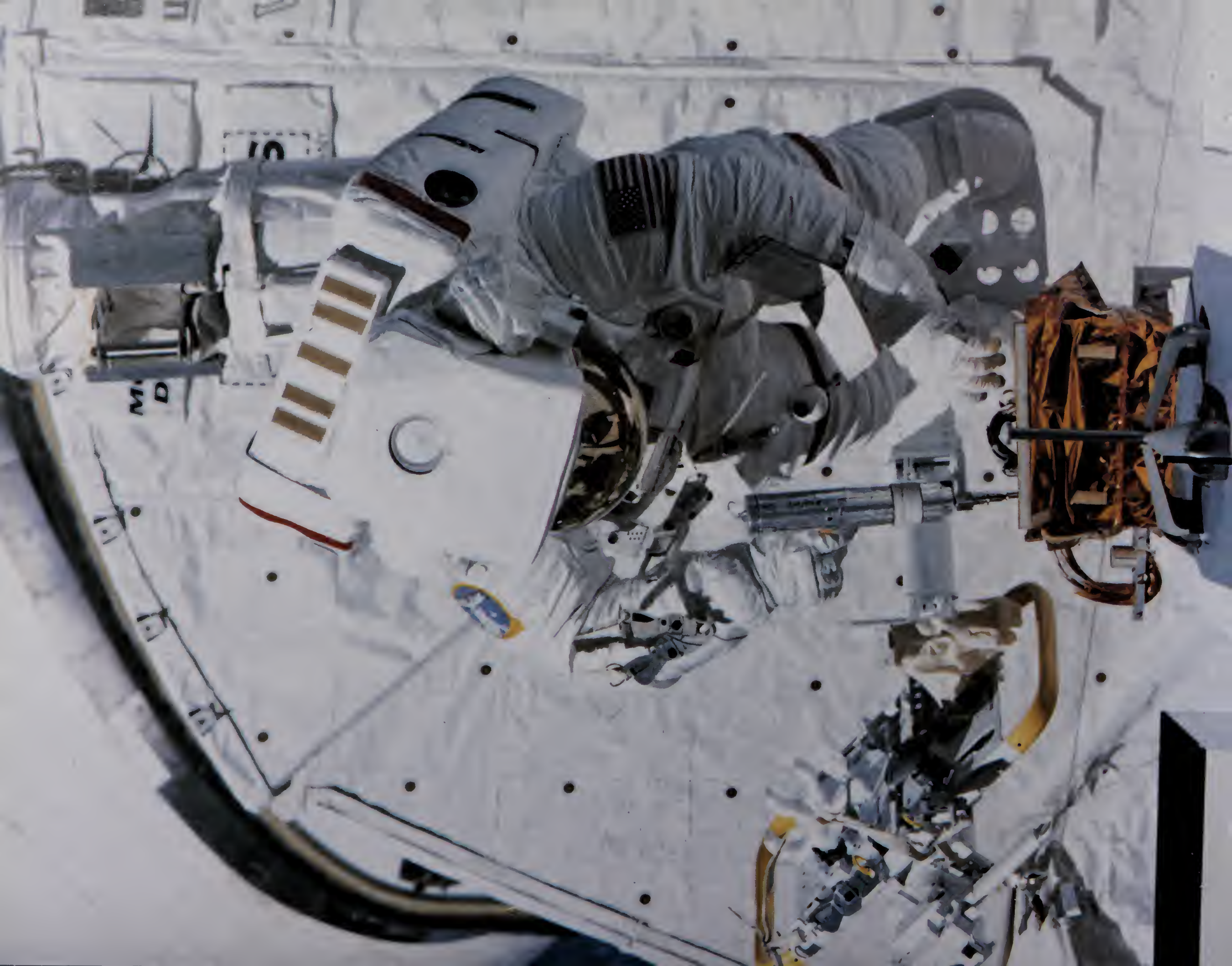
In Mexico, in Puebla, artisans lined a wall with their tool bags at their feet, offering their skills, hoping to meet potential employers. That was all I needed to plunge into the past and see—as if I had been there to witness it myself—baskets of tools back from the forge, being hauled by a rope toward the top of the towers, the spires of the cathedrals.

where one used to split wood that the merchant would bring up the stairs in a bag on his back. We can just press a button to produce heat. But in the country, who won't have a secateur, saw, small mallet, screwdriver, monkey wrench, cold chisel, ax, and billhook? Beside humans, tools swim like dolphins through vast Time. Sometimes there will be many, other times, few, appearing and disappearing. It is thanks to a tool similar to ours, dear to us earthlings, that the courageous American astronaut was able to skillfully join two modules in space—applying a maneuver that is repeated hundreds of times on earth. Of course, scythes and tongs belonging to the blacksmith could become rare. Let us take care. The solidarity between tools and hand has become an essential connection which cannot be broken with impunity.

I would like to say, to conclude this nonlinear examination of tools, that if we distance ourselves too much from these marvels, we might forget our humanity and end up coming back again to tools to help us regain it.

Tools, these iron hands that have allowed us to sculpt and build the world—and even a second world, without tools—can also certainly help to rebuild ruined, broken souls. They are both levers for the material world and symbols that affect our thoughts. We say: cut off a person when speaking, cut short a discussion, hammer out an idea, drive in a point, chisel out an idea, forge a character—because the way we use tools speaks to us. Tools, the product of human intelligence, perfected through use, are infused with our soul and extend our bodies. The eyes of the body perceive them as separate, inanimate objects; the eyes of the spirit, however, perceive their actions, see that object and life extend each other, and relate the tools' movement to the movement of life.

Lifted into space with a power "that impresses the Sun and other stars," hundreds of miles from the place where his mother brought him into the world; this is where astronaut Bruce McCandless works. On the outside. He performs a task upon which the spacecraft and its team might depend. A metal rod is turning, like when, not that long ago, the inventors of fire rolled a stick in their hands—tremendous days like those from Genesis. We jumped from stone to metal and leapt from the human arm to the motor. The attentive eye is the same. The wonderful five-fingered hand is the same; yet we are elsewhere, in infinity. A dizzying adventure dependent on tools. Unbelievable.



Proverbs About Tools

Proverbs make me think of a duck coming out of a pond: with each step its head nods yes, and its tail says no. We easily grasp the truth (it's so clear) behind "like father like son" that we can see the wealthy father and prodigal son, walking arm in arm. Once again we say, "It's really true."

We like proverbs because they are short and spicy and neither true nor false. Older people use them to suggest the extent of their experience—supporting evidence. Young folks cleverly borrow their wisdom and thus can have the final word.

It comes as no surprise that proverbs often refer to tools, those objects that know it all, our everyday companions, shaped in such definite ways that they can become stock characters like those in the commedia dell' arte. The hammer strikes like a violent storm. The file wears away just like greed amasses. The shape of each tool is unique, revealing, and the gestures each inspires is distinctive: one swings the ax and strikes the hammer and files a file. Therefore tools have something in common with the animals in fables: character. It's really true. There are those tools that are violent, and those that are patient; those that are frank and those that are backhanded; those that murmur and those that roar; those that are heavy and those that are light; those that unite and those that divide.

Proverbs tell us what people are thinking.

Sweden

A bad worker

The needle dresses another but remains naked.

Basque

The sieve tells the needle that it has a hole.

Bengal

A bad knife will cut your finger, and not timber.

France

never finds the right tool.

France

The horseshoe that clatters wants a nail.

Spain

Money is the ax that separates inseparable friends.

India

The best blacksmith will sometimes hit his thumb.

Holland

If you are an anvil, withstand;
if you are a hammer, strike.

Arab

**If you step on the blade of a hoe,
its handle will hit you in the face.**

Burma

However high the tree,
the shortest ax
can reach its trunk.

China

With a silver sickle,
one harvests golden sheaves.

Finland

One must not put oneself between the hammer and anvil.

France

A tactless man is like an ax on an embroidery frame.

Malaysia

Time is a file that works without a sound.

Italy

A carpenter who wants to be rich will make plows and caskets.

China

If fortune assists you,
your teeth can break an anvil;
but should it desert you,
your teeth will be broken by eating.

Persia

You are not wasting time when you are sharpening your tools.

France

The cobbler who leaves his country is leaving misery behind, but a king outside his kingdom may die of hunger.

Persia

**The blacksmith forges tongs
so as not to burn himself.**

Russia

There are more
tools than workers.

France

New wood requires
a sharp ax.

Russia

The mother is the one who
takes the knife by the blade.

Bantu

**The blacksmith's children are not
afraid of the sparks.**

Denmark

The final blow
brings down
the oak tree.

France

**One forgets about the builder
once the house is built.**

India

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